DELIMITATION OF DEVELOPMENT REGIONS IN CANADA

(With Special Attention to the Georgian Bay Vicinity)

A Report

Submitted to the Area Development Agency

Department of Industry

Ottawa

Canada

Richard S. Thoman and Maurice H. Yeates

Department of Geography, Queen's University

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FOREWORD

This report has been prepared at the invitation of the Area Development Agency, Department of Industry, Ottawa. Its two major objectives and the time period of research were stated by that Agency at the date of the initial agreement. Basically, the report treats delimitation, rather than evaluation of trends in sector-space-policy relationships, although these ideas overlap. Its preparation has raised a number of additional questions which will be addressed in subsequent studies.

Of the several people to whom the authors express appreciation for their interest, assistance, and helpful commentary, the following names must be specified: Professors Henry W. Castner, Edgar C. Conkling, Gerald McGrath, Richard I. Ruggles, and David W. Slater of the Queen's University Faculty, and student assistants Robert Latham, Gordon Thoman, and Rowland Tinline.

Richard S. Thoman
Maurice H. Yeates

Kingston, Ontario

October 31, 1966

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CHANGES IN MANUSCRIPT

1. Page 17, final paragraph. Data for population pertain to 1965 rather than 1961, and were obtained from the Ontario Municipal Directory rather than from Census Information.

2. Figures II.53 - II.60. Dashed lines do not necessarily go beyond the study area, but are intended merely to break up the overall pattern of solid lines.

3. Figure II.67. The route boundary east of North Bay should be on the highway north of Algonquin Park.

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CHAPTER I

OBJECTIVES, GENERAL ASSUMPTIONS, AND OVERALL RATIONALE

In the growing literature on alleviation of economic and social stress, surprisingly little attention has been given to rationales for drawing boundaries around afflicted areas. Yet this first step is one of the most important. Without accurate delimitation, a redevelopment program may well be "off base" at its outset. Inasmuch as geographers long have been concerned with regional delimitation and interpretation, and recently have developed a number of quantitative techniques useful for the purpose, this study is an effort to utilize both modern and traditional methods in the demarcation of development areas.

OBJECTIVES

The direct objectives of the study are twofold. The first is the delimitation, by whatever means judged to be useful in the five-month study period, of the Georgian Bay Region. The second is the formulation of criteria and principles generally applicable to the delimitation of development regions in Canada, using information sufficiently current and standardized as to be valid on a nation-wide basis.

GENERAL ASSUMPTIONS

Approaching the two objectives specified above has involved the clarification and statement of certain general assumptions, as follows:

1. The region or regions to be delimited are not omni-purpose constructs, but are to be useful to the Area Development Agency for the objectives of that Agency.
2. Those objectives currently emphasize the alleviation of excessive economic stress in certain designated development areas by attracting new activity to those areas.
3. Such economic stress is due directly to chronic and/or severe unemployment, and low family income, in designated areas relative to other areas.
4. Because of national trends in employment away from the primary occupations and towards the tertiary activities, with manufacturing remaining essentially constant, major alleviation to this economic stress is to be sought sectorally in certain tertiary activities and in manufacturing. However, special circumstances may arise, particularly in resource-oriented and tourist areas.
5. These "growth occupations" — tertiary activities and manufacturing — are urban oriented and largely urban centred.
6. In the delimiting of development regions, two distinct but overlapping problems are encountered. The first is identification of conditions of economic stress, and the second is alleviation of those conditions. Identification, using unemployment and family income as criteria, is already being done by the Area Development Agency, despite the fact that the National Employment Service Area, their basic unit of evaluation, appears too large to reveal detailed variation of these criteria from place to place. Although some attention will be given in the earlier phases of this study to identification, the authors assume that the more serious

problem of overall delimitation in terms of research yet to be done is not identification as such, but identification for purposes of alleviation. Therefore the study concentrates upon delimitation of regions for purposes of alleviation. As indicated in points 4 and 5, above, alleviation is to be found in Canada largely in certain tertiary activities and in manufacturing, all of which are urban oriented and most of which are urban centred. This study therefore will be concerned primarily with the selection and application of criteria to delimit individual urban-centred regions, and aggregations of such regions, assuming that such delimitation provides the matrixes for maximum possibility of alleviating econmic stress.

OVERALL RATIONALE

Throughout the study, two kinds of regional concept are utilized.

1. The concept of the homogeneous or formal region involves a spatial inventory of selected natural and cultural features as they actually are distributed over the landscapes of respective study areas. (Geographical distribution is here interpreted as the spatial aggregate of individual locations of selected features or criteria.) By way of examples, the distribution of population, of unemployment, and of family income, plotted as precisely as possible, each can be aggregated into respective homogeneous regions in this type of evaluation.
2. The concept of the functional region involves a central point from which linkages reach into a surrounding territory of mutual interdependence with the point. In this study, the functional region of particular interest is the urban-centred region. Inasmuch as urban

centres vary in population in a range which can be classified into specific groups, such centres may be viewed with respect to certain trading functions as arrayed in an hierarchy of specialized activity, with the trading territories of successively smaller centres located within the territories of larger centres. In other words, certain goods and services are available at urban centres of all sizes, whereas increasingly specialized goods and services are available only in successively larger urban centres. The more specialized the good or service, the larger are the trading sectors of urban centres supplying the good or service, and the larger is the associated trading territory.

Viewed in another way, as to prevailing distance and time involved in journeys to work, the urban-centred regions are not in an hierarchy, but comprise territories which, other things being equal, are essentially of uniform size, inasmuch as the determining factor for each territory is the time and cost of commuting daily to a central place from the associated territory.

The basic research procedure is the superimposition of different homogeneous and functional regions, each mapped by a specified criterion, to test the correspondence of the various regional boundaries. The homogeneous regions can be expected to reveal conditions to be treated — distribution of population, high unemployment, low family income, etc. However, in view of the authors' stated objective to give particular attention to delimitation in terms of regions for alleviation of economic stress (assumption 6, p. 2), emphasis is placed on certain urban-centred regions in delimiting a final boundary for the Georgian Bay Region and in recommending general courses of action for demarcating other development areas in Canada.

Where and when data are available, linkages among selected homogeneous and functional regions are presented. These linkages may take the form of commodity movement, communications flows, and frequent, repetitive personal travel.

In a study of this nature, it is important not only to delimit a region from the viewpoint of the specialist, but also to learn the viewpoints of the region's inhabitants as to that region's boundaries. A portion of this study therefore involves evaluation of the results from a questionnaire sent to representatives of selected communities concerning regional identification and localities of common interest.

Finally, an effort has been made to bring to bear as many methods and techniques as possible in delimiting regions. One possibility involves use of aerial photographs and topographic maps towards this end. A commentary by Professor Gerald McGrath concerning this possibility is included in the Appendix.

CHAPTER II

THE GEORGIAN BAY REGION

The Georgian Bay vicinity is a satisfactory area with which to experiment in regional delimitation in that it (1) is not excessively far from a major metropolitan area, Toronto; (2) is of moderately high population pressure and associated mixtures of urban-rural conditions in its southern portion, and yet (3) extends northward into territory which, except for the Sudbury district, is relatively open and unpopulated. In all likelihood, therefore, conditions encountered there in delimitation of a development region or regions will be representative, in whole or in part, of a range of conditions found elsewhere in Canada. Results from an intensive study of the Georgian Bay vicinity hence can be expected to have significance beyond that vicinity.

THE STUDY AREA

The study area is shown in Figures II.1 and II.2. It includes the boundaries of existing official delimitations of the Georgian Bay Region — namely, the aggregation of development areas delimited by the Area Development Agency at the time of this writing, and the Georgian Bay Region as recognized by the Province of Ontario on the basis of the Camu-Weeks-Sametz regional system[1] — plus any peripheral territory that might conceivably be part of a Georgian Bay Region. This peripheral territory involves a minimum thickness of a tier of townships plus additional townships where deemed necessary.

Because the study area is separated into a southern section which is

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1. Camu, Pierre, E. P. Weeks, and Z. W. Sametz, Economic Geography of Canada. Toronto: MacMillan of Canada, 1964, especially p. 325.

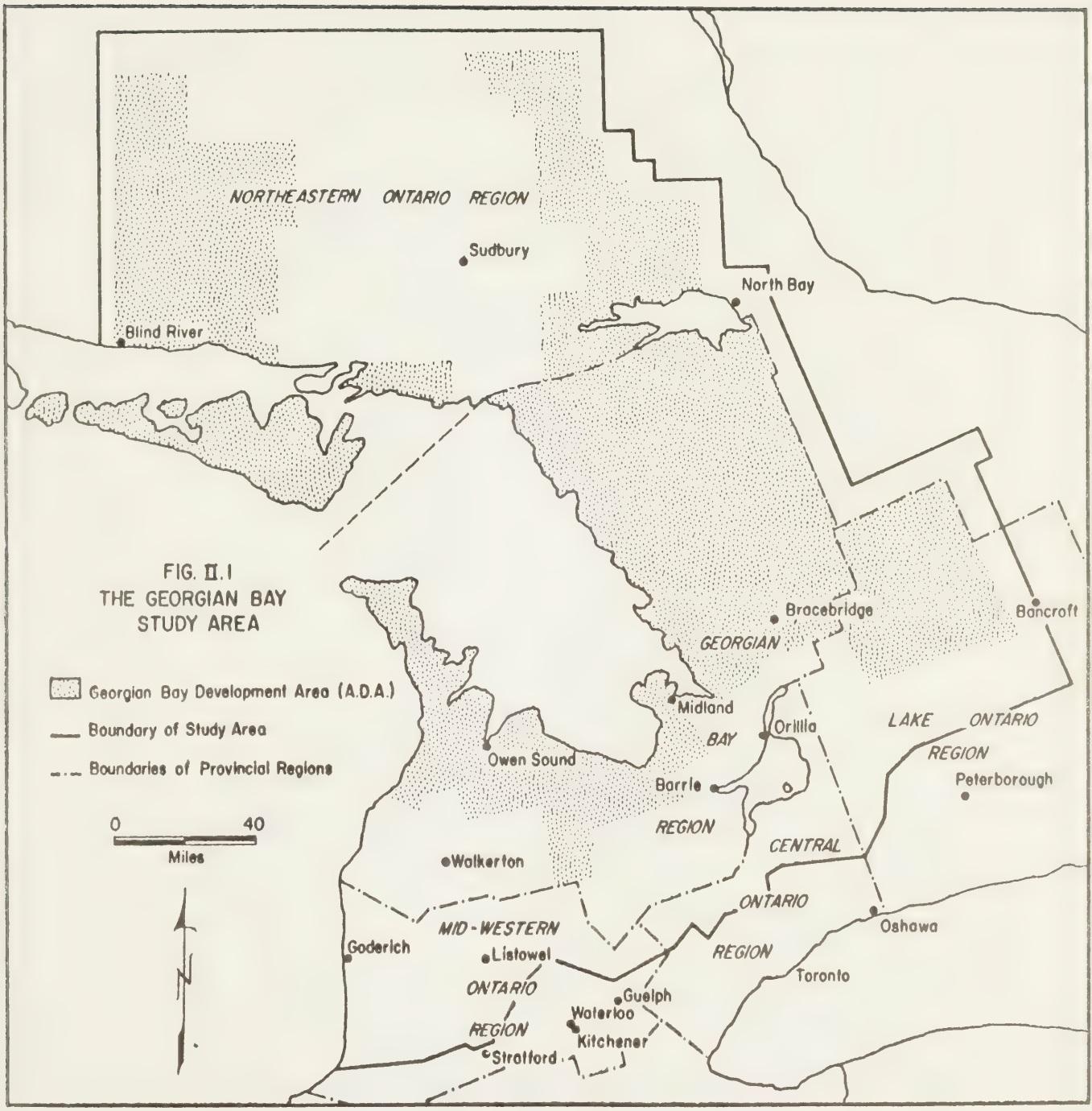


FIG. II.1
THE GEORGIAN BAY
STUDY AREA

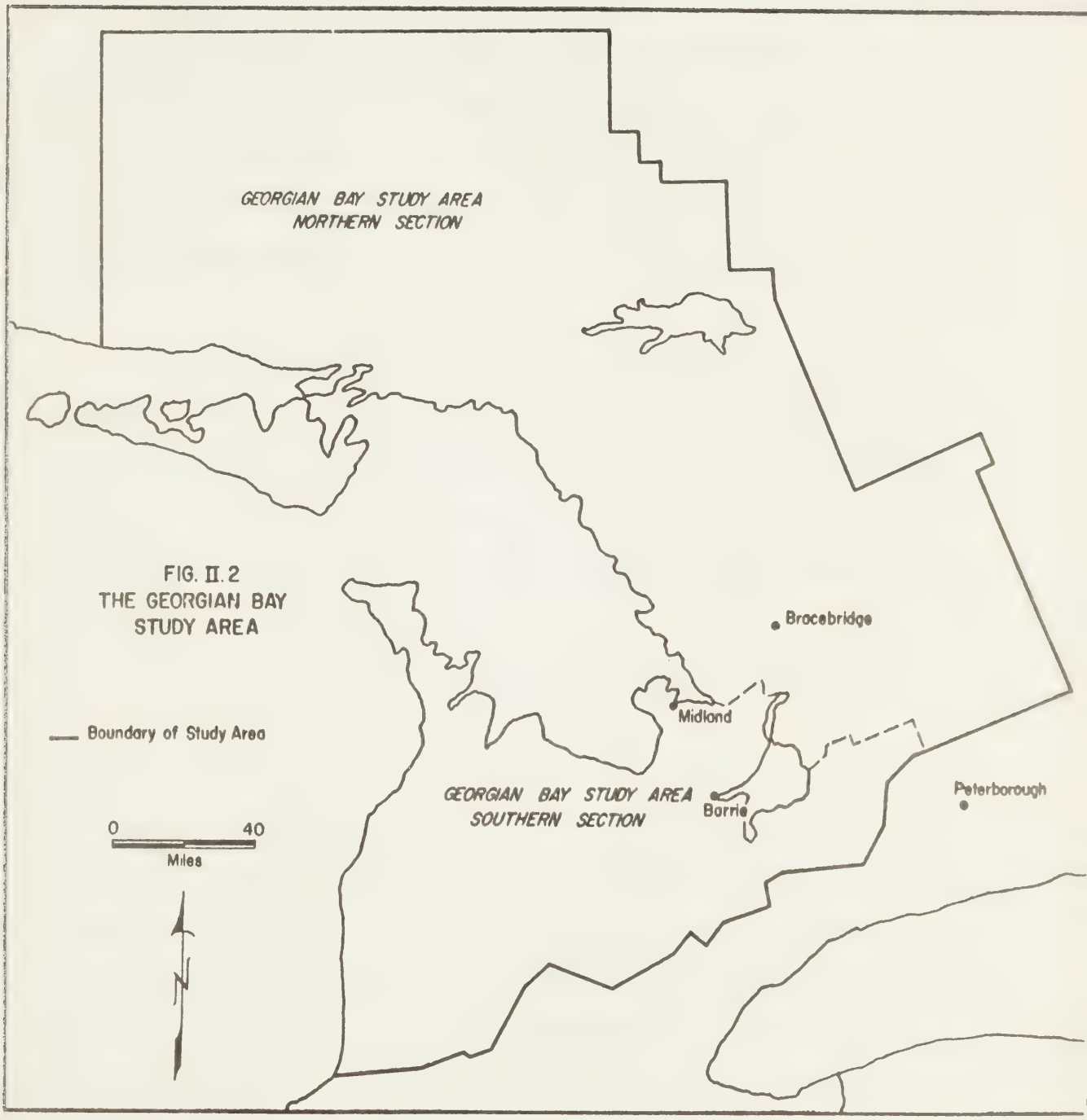


FIG. II.2
THE GEORGIAN BAY
STUDY AREA

intensively used and heavily populated, and a northern section which, except for Sudbury and smaller communities is relatively unused and unpopulated, a line was drawn early in the research period between these two sections (Figure II.2). The line is based on two criteria: (1) population density of 60 per square mile or over, and/or (2) intensity of land use as shown in a generalized map for the forthcoming Atlas of Canada entitled, "Land Use of Southern Ontario", scale 1:1,000,000,compiled by the Geographical Branch, Department of Mines and Technical Surveys, 1960.

The southern portion of the divided study area received the most attention in research. In addition, some detailed field work was done as far north as Parry Sound (Figure II.2). The northern portion was examined by reconnaisance visits to the local communities and through library sources, especially theses and dissertations. Unless noted, a reference hereafter in this study to Georgian Bay is in fact a reference to the southern section.

CRITERIA OF INITIAL CONSIDERATION

An homogeneous geographical region can be delimited on the basis of a very wide range of natural and cultural (man-made) criteria, and a functional region on a narrower but still broad range of cultural criteria. Delimitation for a specific purpose — in this case, for identification and assistance of economic stress — reduces the number of relevant criteria and narrows the range of selection. Nevertheless, criteria of initial serious consideration at the outset of the Georgian Bay study were:

1. Homogeneous regions.
    a. Natural criteria.
        (1) Tectonic structure and relief.
        (2) Watersheds and drainage basins.

(3) Climate.

(4) Soils.

(5) Uncultivated vegetation.

(6) Wild life, including fish.

(7) Relevant mineral resources.

b. Human and cultural criteria.

(1) Population density and distribution.

(2) Urban-rural distinctions.

(3) Per cent employed.

(4) Family income.

(5) Primary activities.

(a) Distribution and density, by type.

(b) Size of labour force, by type.

(c) Capital investment, by type and total.

(d) Value of product, by type and total.

(6) Secondary activities.

(a) Distribution and density, by SIC group.

(b) Size of labour force, by SIC group.

(c) Value of product and value added, by SIC group.

(d) Concentration tendencies and association with urban size categories, by SIC group.

(7) Tertiary activities.

(a) Distribution and density, by SIC group.

(b) Size of labour force, by SIC group.

(c) Agglomeration tendencies and association with urban size categories, by SIC group.

2. Functional regions.

a. Primary activities.

(1) Commodity linkages, incoming and outgoing, to specified enterprise and industry types, at differing levels of observation.

(2) Journey-to-work linkages, considered as in 2a (1), above.

(3) Shopping patterns, considered as in 2a(1), above.

b. Secondary activities.

(1) Commodity linkages, as in 2a(1), above, considered by SIC group and total pattern.

(2) Journey-to-work linkages, as in 2a(1), above, considered by SIC group and total pattern.

c. Tertiary activities.

(1) Commodity and service linkages, as in 2a(1), above, considered by SIC group and by total pattern.

(2) Journey-to-work linkages, as in 2a(2), above.

3. Dynamic aspects.

a. Changes over specified time periods, selected aspects of homogeneous regions.

b. Changes over specified time periods, selected aspects of functional regions.

SELECTION OF CRITERIA FOR FINAL CONSIDERATION

It became clear early in the study that a full assessment of all of the criteria listed in the preceding section was not possible in the time period specified for the study. It also became clear that certain necessary criteria were to be based on data that would need to be gathered in the field. Accordingly, each of the above criteria of initial consideration was re-examined carefully as to its direct relevance to the problem at hand, particularly in terms of immediate technological and economic feasibility in alleviating conditions of economic stress. Natural environmental criteria, while very important, have little direct relevance to development area delimitation that can be easily implemented. For example, the effect

of a climatic hindrance to occupance of the northlands is definite, but current levels of technology do not allow serious consideration of alleviating economic stress by reducing climatic excesses. Natural criteria hence were not considered in the criteria finally selected. Primary activities as such also were excluded because (1) their current efficiency is revealed in present data on unemployment and family income, and (2) they are declining sources of unemployment, and would be important only in certain areas that would need to be considered as special cases. Data on capital investment, value added, and value of product were excluded because this information was not supplied by all firms. Unemployment rate and family income, while critical considerations, presently are calculated by Area Development Agency and therefore are known quantities as they occur within National Employment Service Areas. Furthermore, the primary objective in this study is delimitation in terms of alleviation rather than identification, so that the criteria to be selected ought to reflect spatial matrixes for alleviation of economic stress. Finally, considerations of change over time, while very important, do not lend themselves to circumstances for which data are especially collected, inasmuch as similar data were not collected for earlier periods. Except where noted, therefore, this important aspect is reserved as a primary consideration in a future study.

In view of the assumptions in the preceding chapter, particularly assumption 6, the major criteria for this study have been chosen to indicate the nature and extent of the urban-centred region, viewed at differing levels of observation.

CRITERIA OF FINAL CONSIDERATION

Criteria of final consideration in the delimitation of the Georgian Bay Region were:

1. Homogeneous regions.

   a. Density, distribution, and selected urban-rural aspects of population.

   b. Density and distribution of land use.

   c. Density and distribution of secondary activities.

   d. Concentration tendencies of selected secondary activities.

   e. Association of selected secondary activities with urban size categories.

   f. Density and distribution of selected tertiary activities.

   g. Agglomeration tendencies of selected tertiary activities, and association with urban size categories.

2. Functional regions.

   a. Commodity linkages (inflow and outflow) of selected secondary activities, considered by SIC groups.

   b. Journey-to-work linkages of secondary activities (manufacturing), considered as representative of overall journey-to-work patterns.

   c. Commodity and service linkages of selected tertiary activities, and resultant hierarchy of central places.

SELECTED POPULATION CHARACTERISTICS AS CRITERIA FOR DELIMITATION

We have indicated earlier that population density and distribution were used as criteria in separating a northern section from a southern section of the Georgian Bay study area (Figure II.2). The northern section then was examined by traverse visits to leading centres, and the southern section by intensive field work.

A closer look at the density and distribution of total, urban, and rural population in the southern section and the southern fringe of the northern section is shown in Figures II.3, II.4, and II.5. Total and urban populations are concentrated especially along and adjacent to the Midland-Barrie-Toronto axis cored by Highway 400, and display uneven intensity elsewhere. Density is intermediate to the west

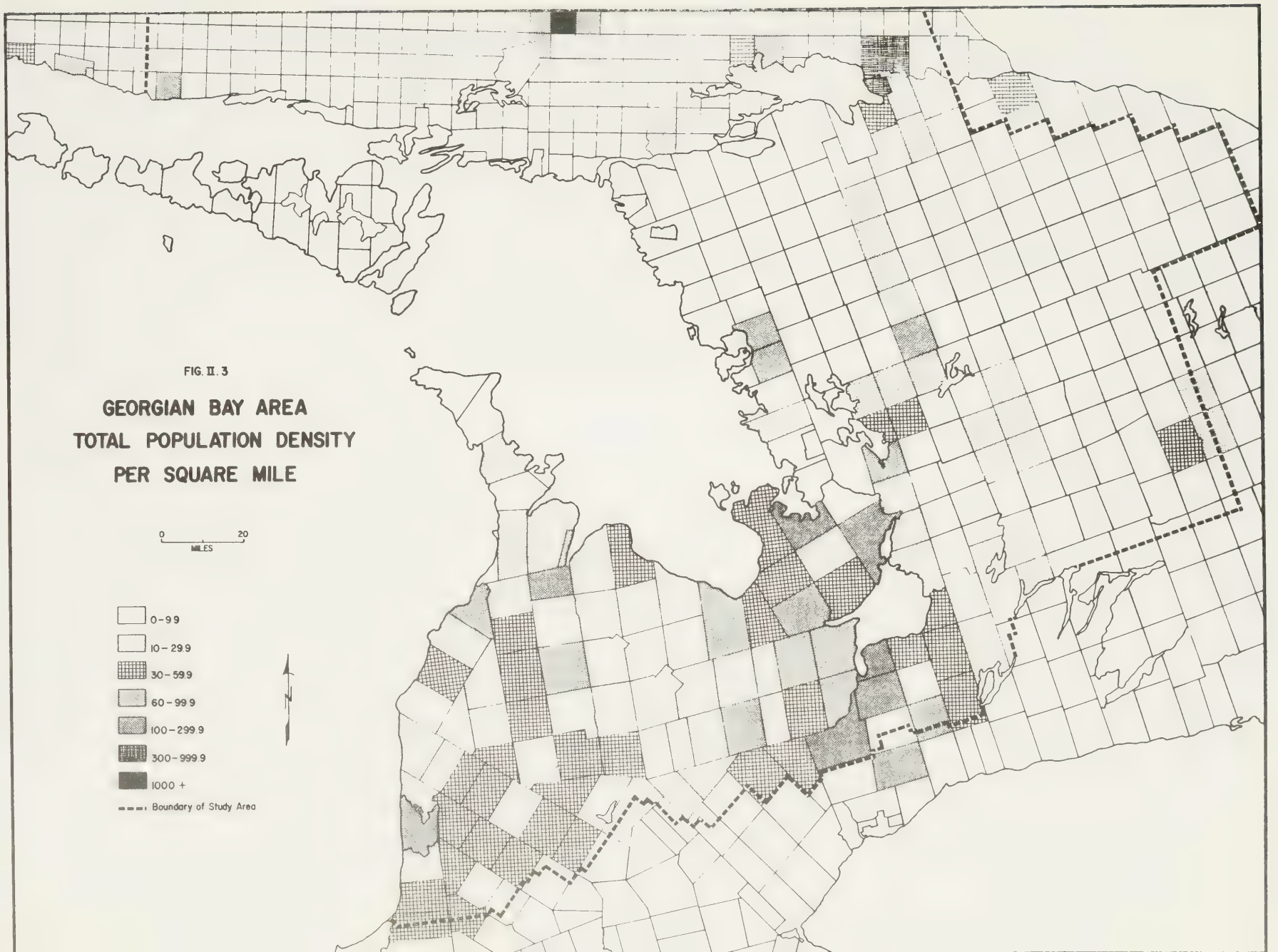


FIG. II. 3
GEORGIAN BAY AREA
TOTAL POPULATION DENSITY
PER SQUARE MILE
0
20
MILES
0-9.9
10-29.9
30-59.9
60-99.9
100-299.9
300-999.9
1000 +
Boundary of Study Area
N

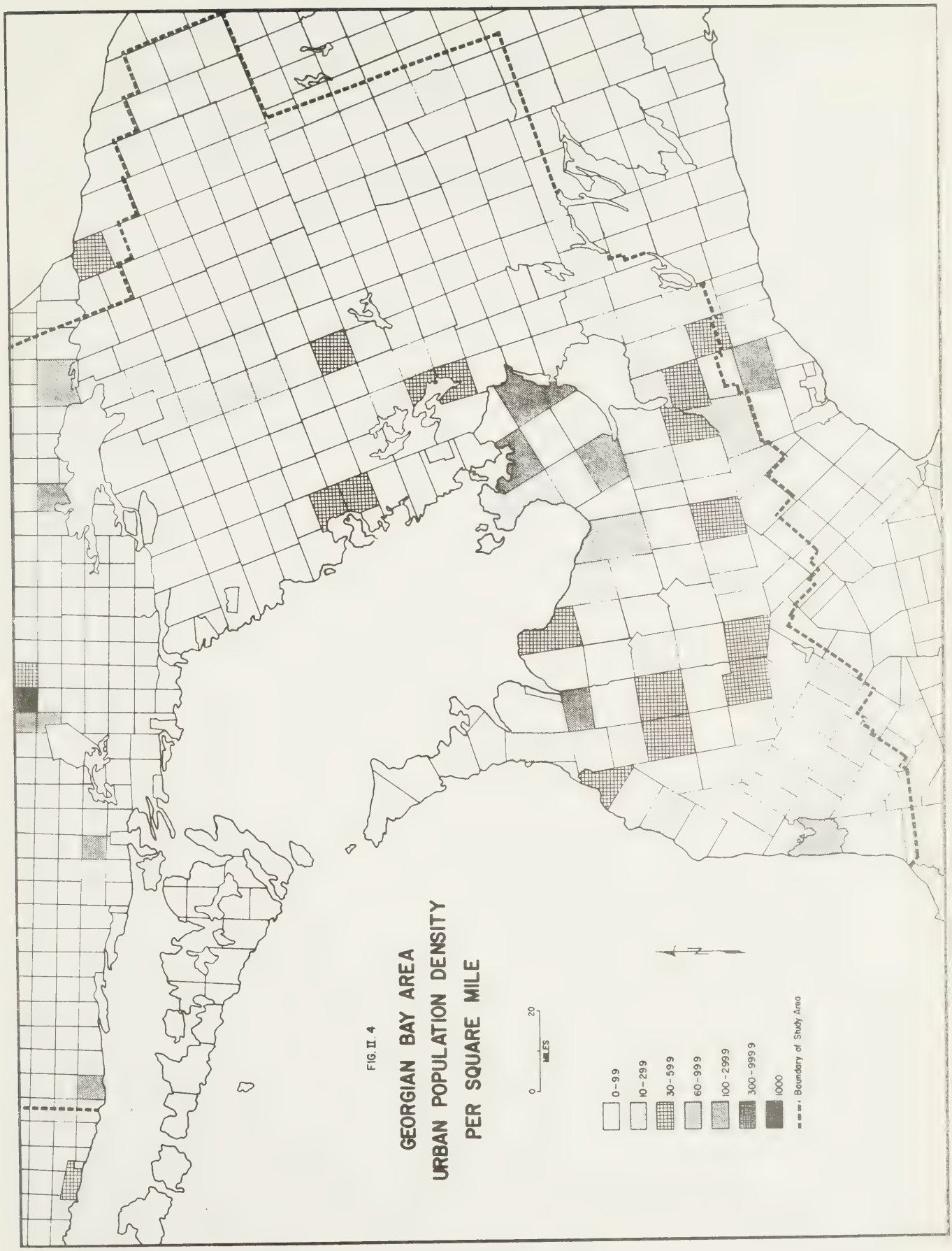


FIG. II. 4
GEORGIAN BAY AREA
URBAN POPULATION DENSITY
PER SQUARE MILE
0
20
MILES
0-99
100-299
300-599
600-999
1000-2999
3000-9999
10000
Boundary of Study Area

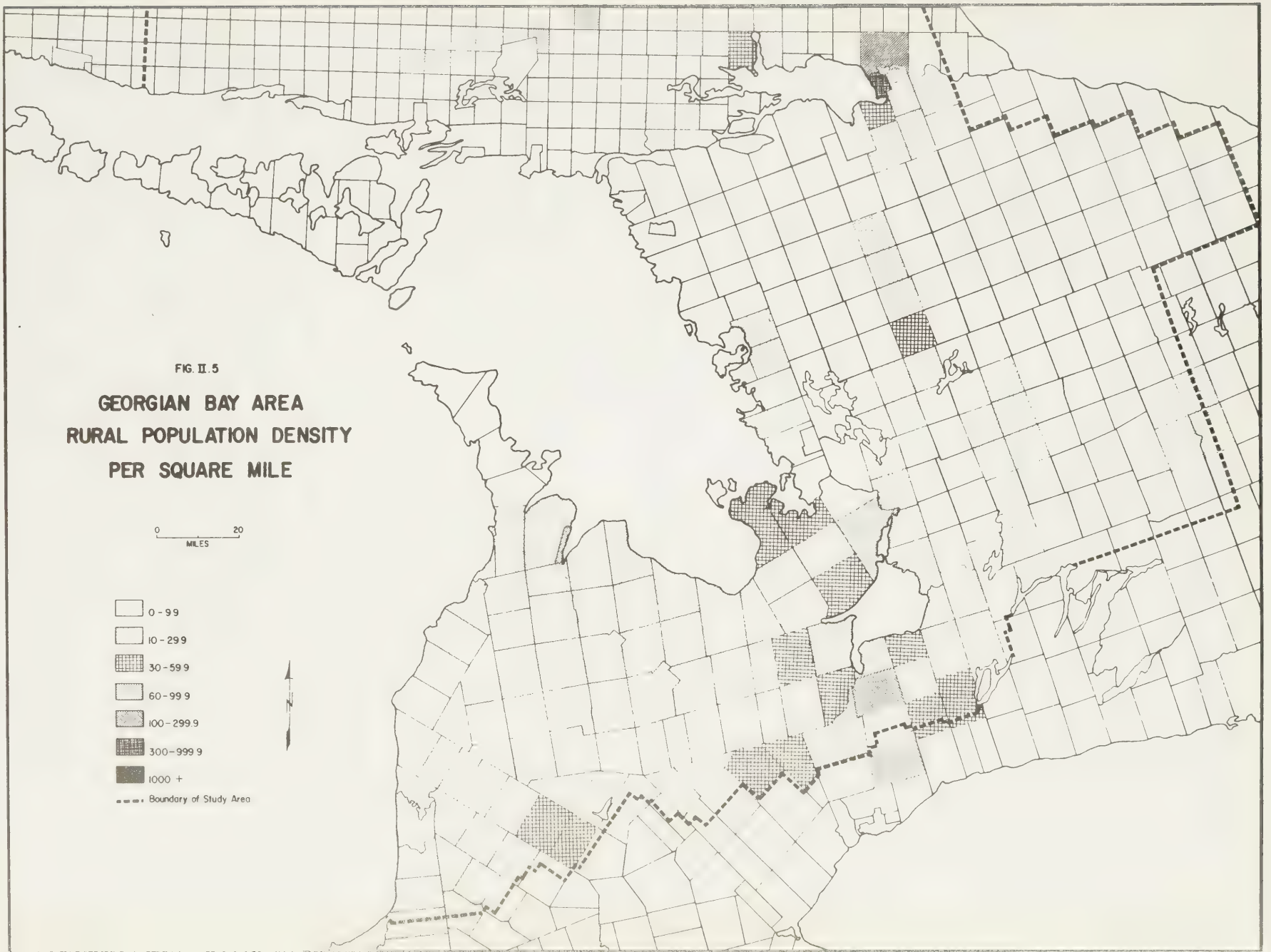


FIG. II.5
GEORGIAN BAY AREA
RURAL POPULATION DENSITY
PER SQUARE MILE
0
20
MILES
0 - 9 9
10 - 29 9
30 - 59 9
60 - 99 9
100 - 299.9
300 - 999 9
1000 +
Boundary of Study Area
N

of this axis, and sporadically light to the east. If viewed in sectors reaching north from centres on the coast line of Lake Ontario, this density does not increase markedly as one approaches the southern boundary of the study area. Rural population displays a large pattern of low density throughout most of the western portion of the southern Georgian Bay vicinity, and also is more concentrated along the Midland-Barrie-Toronto axis while displaying a sparse and uneven pattern to the east and northeast. Density of all three maps is especially light to the north except where urban units occur.

Population density and distribution thus are of value in separating a more complex southern section from a less complex northern section (in terms of human settlement and occupance). Although full field study might be desirable for all areas of possible consideration, a separation can be made on the basis of necessity between areas to be studied through reconnaissance and those to be studied by intensive field work and other methods.

Furthermore, population density may be useful in delimiting subregions within the southern section of the study area. This possibility will be examined in its proper place when regional boundaries are established.

(A final note on Figures II.3 - II.5 involves procedures for gathering data. Census figures for 1961 were used with respect to numbers of people. Both the Dominion Bureau of Statistics and the Department of Lands and Forests of the Province of Ontario were consulted with respect to the actual sizes of respective townships. Final results then were compared with a population density map in preparation at the Geographical Branch, Department of Mines and Technical Surveys.)

MANUFACTURING AS A CRITERION FOR DELIMITATION

Table II.1 shows that manufacturing remained essentially constant on a relative basis as a source of employment in Canada between 1954 and 1963. Because of this stability, manufacturing offers some possibilities of employment (and associated alleviation of economic stress), but not so many possibilities as selected tertiary activities, particularly services. For certain localities, manufacturing may have an importance above the national average, and for others below that average. To date, efforts by the Area Development Agency to alleviate economic stress have involved attraction of manufacturing plants to the afflicted areas. The present geographical distribution of manufacturing might be particularly important to delimitation from the viewpoint of that Agency.

We shall mention here four aspects of manufacturing, considering the first three in detail at this time and reserving the fourth for a special section because of its importance to the overall study. These are: (1) concentration, by Dominion Bureau of Statistics Standard Industrial Classification, (2) industry mix within urban units of specified size categories, (3) flows of commodities to and from plants, and (4) journey-to-work patterns. As will be seen in the discussion, these criteria are not mutually exclusive.

Manufacturing Concentration

A criterion of possible value in delimiting the Georgian Bay Region is the spatial concentration of manufacturing. A map of the geographical distribution of the manufacturing labour force of the study area indicates a tendency for concentration in the southern section, if one excludes the heavy mining and early-stage processing at Sudbury (Figure II.6). This concentration can be expected to increase in intensity towards Toronto. Furthermore, there are no sharp north-south nor east-west differences in concentration intensity of all manufacturing activity

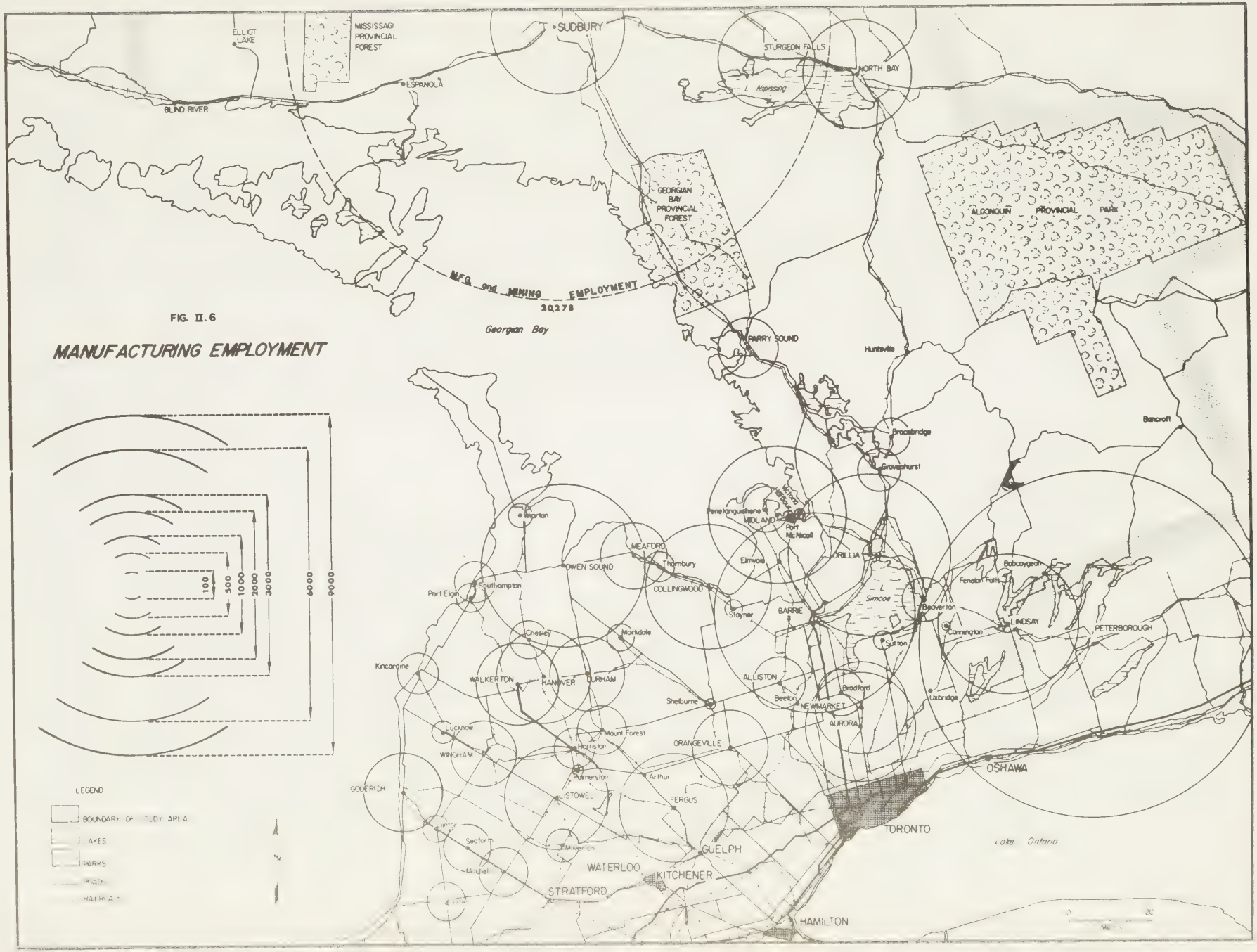
TABLE II.1

Percentage Distribution of Canadian Employed by Industrial Group

Year	Total Employed (000)	PERCENTAGE DISTRIBUTION							
		Agri-culture	Other Primary Indus-tries	Manu-fac-turing	Con-struc-tion	Trans-porta-tion	Trade	Finance, Insurance & Real Estate	Service
1949[1]	4,666	25.4	4.0	26.0	4.8	8.1	12.3	2.6	16.8
1954	5,243	16.8	4.1	25.3	6.4	8.7	15.8	3.2	19.7
1963	6,364	10.1	2.8	25.3	7.1	8.5	16.0	4.0	26.2

1. Excludes Newfoundland.

Source: Canada Year Book, 1965, p. 724


ELLIOT LAKE
MISSISSAGI PROVINCIAL FOREST
SUDBURY
STURGEON FALLS
NORTH BAY
L. Nipissing
ESPANOLA
BLIND RIVER
GEORGIAN BAY PROVINCIAL FOREST
ALGONQUIN PROVINCIAL PARK
MFG. and MINING EMPLOYMENT
20278
Georgian Bay
PARRY SOUND
Huntsville
Bancroft
Brockbridge
Gravenhurst
Victoria Harbour
Penetanguishene
MIDLAND
Port McNicoll
ORILLIA
Elmvale
Wiarton
MEAFORD
Thornbury
OWEN SOUND
COLLINGWOOD
Port Elgin
Southampton
Stayner
BARRIE
L. Simcoe
Beaverton
Fenelon Falls
Bobcaygeon
LINDSAY
Cannington
Sutton
PETERBOROUGH
Chesley
Mordale
Kincardine
WALKERTON
HANOVER
DURHAM
ALLISTON
Beeton
Shelburne
NEWMARKET
Bradford
Uxbridge
AURORA
Lucknow
Mount Forest
ORANGEVILLE
WINGHAM
Harriston
Palmerston
Arthur
OSHAWA
GODERICH
LISTOWEL
FERGUS
Seaforth
Milverton
TORONTO
Lake Ontario
GUELPH
WATERLOO
KITCHENER
Mitchell
STRATFORD
HAMILTON
0 20
MILES
FIG. II.6
MANUFACTURING EMPLOYMENT
100
500
1000
2000
3000
6000
9000
LEGEND
BOUNDARY OF STUDY AREA
LAKES
PARKS
ROADS
RAILWAYS

along the southern tier of townships marking the "screen line" of the study area. Overall concentration of manufacturing therefore is not of substantial value in delimiting the Georgian Bay Region.

We are left with the possibility of using spatial concentrations of manufacturing types.[2] In the field work for the Georgian Bay study, selected information was gathered from all manufacturing plants with employment of ten or more. In the examination of types of manufacturing, these plants were grouped by type of product into eighteen industries as listed in the Standard Industrial Classification of the Dominion Bureau of Statistics, and then were cross-referenced by towns of 1,000 or over, using manufacturing employment as the basic unit of examination (Table II.2). In addition to absolute data noted in the table, percentages were calculated of the employment in each industrial grouping with respect to the total manufacturing employment of a town. These percentages became a major component of subsequent analysis, aggregately revealing relative concentration in employment.

Research procedure. The research procedure in determining possible concentration of industry involved three basic criteria: (1) the minimum relative concentration in employment that qualified a town for consideration; (2) the maximum distance separating individual towns grouped into a single spatial unit of concentration, and (3) the minimum number of towns to be considered in such a unit. In establishing the first criterion, two considerations emerged. One involved norms with which the relative concentration of employment in manufacturing of a town could be compared. Three possible spatial units were considered for establishing such norms. These were the study area, the Province of Ontario, and

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2. This section on relative concentration of employment in manufacturing was prepared through the first draft stage by Rowland Tinline.

TABLE II.2 (on next two pages)

Manufacturing in Communities of the Georgian Bay Study Area
by Standard Industrial Classification*

(In Per Cent of Labour Force within each Community)

Town	Total Manufacturing Employment	Food & Beverage Industries %	Rubber Industries %	Leather Industries %	Textile Industries %	Knitting Mills %	Clothing Industries %	Wood Industries %
Alliston	332	34.94	-	-	-	-	-	19.88
Aurora	1,225	10.76	-	27.89	-	-	-	-
Barrie	3,559	5.90	11.24	9.92	2.11	-	-	0.84
Beaverton	233	-	-	-	-	-	-	-
Bracebridge	188	-	-	-	-	-	-	-
Bradford	16	-	-	-	-	-	-	100.00
Cannington	14	100.00	-	-	-	-	-	-
Chesley	190	-	-	-	-	-	-	-
Clinton	98	37.76	-	-	-	25.51	-	-
Collingwood	1,555	6.43	-	-	-	-	3.86	0.71
Durham	613	2.77	-	-	-	-	23.65	35.56
Exeter	169	65.69	-	-	-	-	-	-
Fenelon Falls	40	-	-	-	100.0	-	-	-
Fergus	1,198	2.75	-	16.69	-	-	-	-
Goderich	535	-	-	-	-	-	-	18.69
Gravenhurst	237	10.97	-	-	-	-	-	-
Hanover	946	21.67	-	-	-	1.59	-	8.99
Harriston	200	80.00	-	-	-	-	-	10.50
Huntsville	199		-	-	-	-	-	94.47
Kincardine	197	17.77	-	-	-	-	-	-
Listowel	1,108	46.03	-	-	38.36	-	-	4.78
Lucknow	77	28.57	-	-	-	-	-	71.43
Markdale	115	-	-	89.57	-	-	-	-
Meaford	659	-	-	-	28.07	-	-	16.69
Midland	1,833	10.91	-	6.82	-	-	6.82	1.31
Milverton	140	-	-	-	-	-	-	-
Mitchell	287	24.39	54.70	-	-	-	-	12.20
Mount Forest	285	-	-	-	-	-	22.81	35.09
Newmarket	925	-	-	-	-	-	-	1.73
North Bay	1,247	8.74	-	-	-	-	-	6.42
Orangeville	724	2.76	-	-	-	-	-	-
Orillia	2,449	2.94	4.08	-	-	-	0.69	4.49
Owen Sound	2,434	2.67	-	0.90	-	-	-	5.96
Palmerston	19	100.00	-	-	-	-	-	-
Parry Sound	425	-	-	-	-	-	-	-
Penetanguishene	271	9.59	-	49.82	-	-	-	22.14
Port Elgin	120	-	-	-	-	-	-	-
Port McNicoll	15	-	-	-	-	-	100.00	-
Seaforth	280	13.93	-	45.71	-	-	-	-
Shelburne	20	50.00	-	-	-	50.00	-	-
Southampton	232	-	-	-	-	-	-	19.40
Stayner	35	100.00	-	-	-	-	-	-
Sturgeon Falls	987	-	-	-	-	-	-	100.00
Sudbury	1,726	34.42	-	-	-	-	-	23.24
Sutton	65	100.00	-	-	-	-	-	-
Thornbury	118	28.81	-	-	-	-	-	-
Victoria Harbour	22	-	-	100.00	-	-	-	-
Walkerton	765	31.11	-	-	-	-	-	23.14
Wiarton	85	-	-	-	-	-	41.18	29.41
Wingham	489	-	-	5.93	-	-	-	51.14
% Breakdown, Study Area	100%	11.19	2.21	4.93	2.44	0.17	1.55	11.46
% Breakdown, Province of Ont.	100%	11.18	2.32	2.78	4.19	1.69	4.18	2.91
% Breakdown, Canada	100%	13.32	1.62	2.88	5.46	1.98	7.91	7.25

* Two SIC groupings, Tobacco Products and Petroleum and Coal Products, are not represented in the study area and are not included. Data pertain to the southern section of the study area (Figure II.2), plus seven communities in the northern section for which information was obtained from field work or local chambers of commerce. These communities are Bracebridge, Gravenhurst, Huntsville, North Bay, Parry Sound, Sturgeon Falls, and Sudbury. There is no manufacturing in Arthur and all data were not released at Uxbridge. Both are deleted. Manufacturing employment in a large concern at Sudbury is omitted because data for an SIC breakdown were not released.

Source: Compiled and calculated by authors from field data except as noted above. Data for Ontario and Canada are from the 1961 Census of Canada.

Furniture & Fixture Industries %	Paper & Allied Industries %	Printing, Publishing & Allied Industries %	Primary Metal Industries %	Metal Fabricating Industries (Except Machinery & Transportation Industries) %	Machinery Industries (Except Electrical Machinery) %	Transportation Equipment Industries %	Electrical Products Industries %	Non-Metallic Mineral Products Industries %	Chemical & Chemical Products Industries %	Miscellaneous Manufacturing Industries %
-	-	-	-	-	-	-	-	-	45.18	-
-	1.59	-	10.76	-	-	11.95	-	3.75	33.30	-
-	-	-	-	7.70	19.86	-	27.32	0.70	3.93	10.48
-	-	-	-	14.59	-	85.41	-	-	-	-
-	-	-	-	32.45	-	67.55	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
94.74	-	-	-	-	-	-	5.26	-	-	-
-	-	-	-	-	-	-	-	-	-	36.73
22.96	-	-	-	-	-	49.97	5.14	10.29	-	0.64
38.02	-	-	-	-	-	-	-	-	-	-
7.10	-	-	-	-	11.83	15.38	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	13.77	-	-	54.26	-	12.53	-	-	-
-	-	-	-	1.87	59.82	7.10	-	-	-	12.52
-	-	-	-	-	-	8.44	-	-	-	80.59
60.35	-	-	-	-	-	-	-	-	-	7.40
-	-	-	-	-	-	-	-	-	9.50	-
-	-	-	-	-	-	-	-	5.53	-	-
82.23	-	-	-	-	-	-	-	-	-	-
10.83	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
10.43	-	-	-	-	-	-	-	-	-	-
4.55	-	-	-	48.41	-	2.28	-	-	-	-
2.89	-	-	-	31.10	4.36	2.73	2.73	-	-	30.33
71.43	-	-	-	-	10.71	-	-	-	-	17.86
-	-	-	-	-	-	-	-	8.71	-	-
-	-	-	-	-	-	-	42.10	-	-	-
51.67	-	-	-	14.38	-	10.92	-	-	-	21.30
-	-	-	-	46.03	-	3.61	-	10.18	19.01	6.01
-	-	-	-	13.95	-	34.54	13.81	-	12.15	22.79
-	-	-	33.74	13.56	27.56	9.60	-	0.65	2.69	-
20.54	1.31	16.43	-	-	21.05	10.68	20.05	-	0.41	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	58.82	-	-	41.18	-
-	-	-	-	-	-	18.45	-	-	-	-
-	-	-	-	-	-	-	-	-	-	100.00
-	-	-	-	-	-	-	-	-	-	-
20.00	-	-	-	16.43	-	-	-	3.93	-	-
-	-	-	-	-	-	-	-	-	-	-
80.60	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	9.15	1.74	17.32	-	-	-	6.60	7.53	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	71.19	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
20.91	-	-	-	10.46	-	-	14.38	-	-	-
-	-	-	-	-	-	-	29.41	-	-	-
6.13	-	-	22.49	14.31	-	-	-	-	-	-
10.90	0.18	2.43	3.70	10.04	10.02	8.72	7.08	1.77	4.82	6.34
2.77	6.44	4.92	9.94	9.97	4.94	10.21	8.66	3.64	4.01	5.25
2.85	7.96	4.42	7.34	8.18	3.22	8.91	5.98	3.48	3.26	3.98

the nation as a whole (Table II.3). Data pertaining to Ontario were accepted as norms, inasmuch as the study area was too small a matrix for adequate consideration, and the entire country too large. Relative concentrations (Figures II.7 - II.14) were calculated for each SIC industry in each centre in Table II.2. (Note that these were calculated for each centre, and not by study area averages). In a very few cases where relative concentrations in particular industries approached but did not reach accepted norms, this procedure was amended to include an industry which accounted for an absolute employment in a given town greater than one-third of the employment in that same industry in the largest town in the study area.

The second criterion was established by considering journey-to-work patterns, discussed in greater detail later in this chapter. As will be shown in that section of the chapter, daily travel to work seldom exceeds 40 miles in one-way distance. Therefore no towns more than 40 miles apart (highway distance) were included in the same unit of spatial concentration. These were considered as neighboring towns. McQuitty linkage techniques[3] were first applied. Towns reciprocally closest to each other, considered by highway distance, were chosen as core points. Subsequently, nearest neighbor towns were linked to these cores (although, of course, the nearest neighbors of the core towns themselves are each other). These added linkages were not reciprocal. Thus in the furniture and fixture industry (Figure II.7), Hanover and Walkerton are core points, and Chesley, Durham, Markdale, and Kincardine are outlying towns in one unit of spatial concentration. Another unit of spatial concentration involves Listowel and Milverton as core points plus Wingham, which is included with this spatial

3. These techniques involve linking neighboring elements of similar types. See McQuitty, L.L., "Elementary Linkage Analysis for Isolating Orthogonal and Oblique Types and Typal Relevancies," Journal of Education and Psychological Measurement 17: 207-229 (1957).

TABLE II.3

Relative Concentration in Manufacturing Employment, by SIC Industry, in the Georgian Bay Study Area, the Province of Ontario, and Canada.

(In per cent of respective manufacturing labour forces)

Industry	Study Area Concentration	Ontario Concentration	Canadian Concentration
Food and beverages	11.2	11.2	13.3
Transportation equipment	8.7	10.2	8.9
Metal fabricating	10.0	10.0	8.2
Primary metals	3.7	9.9	7.3
Electrical products	7.1	8.7	6.0
Paper & allied products	0.2	6.4	8.0
Miscellaneous manufacturing	6.3	5.3	4.0
Machinery, except electrical	10.0	4.9	3.2
Printing, publishing, and allied products	2.4	4.9	4.4
Textiles*	2.4	4.2	5.5
Clothing*	1.6	4.2	7.9
Chemical products	4.8	4.0	3.3
Non-metallic mineral products	1.8	3.6	3.5
Wood	11.5	2.9	7.3
Leather	4.9	2.8	2.9
Furniture	10.9	2.8	2.9
Rubber	2.2	2.3	1.6
Knitting*	0.2	1.7	2.0

*Textiles, clothing and knitting, considered as a single group, have a relative concentration of 4.2 in the study area, 10.1 in the Province and 15.4 in Canada as a whole. However, this industry is highly concentrated within certain localities, and will be considered later in terms of spatial concentration. Columns will not add exactly to 100 because of rounding off from detailed information in Table II.2.

Source: Table II.2.

FIG. II. 7

FURNITURE AND FIXTURE INDUSTRY

Areas of Spatial Concentration

Small Numbers Show Relative Concentration of Employment

Large Numbers Show Commuting Distances

Neighbouring Towns

0 20
MILES

FIG. II. 8

LEATHER INDUSTRY

FIG. II. 9

TRANSPORT EQUIPMENT INDUSTRY

- Areas of Spatial Concentration
- Small Numbers Show Relative Concentration of Employment
- Large Numbers Show Commuting Distances
- Neighbouring Towns

0 20
MILES

FIG. II. 10

CHEMICAL PRODUCTS INDUSTRY

Not shown: North Bay (19.0) and Sudbury (7.5)

FIG. II.11

TEXTILES, CLOTHING AND KNITTING INDUSTRIES

Not shown: Fenelon Falls (100.0)

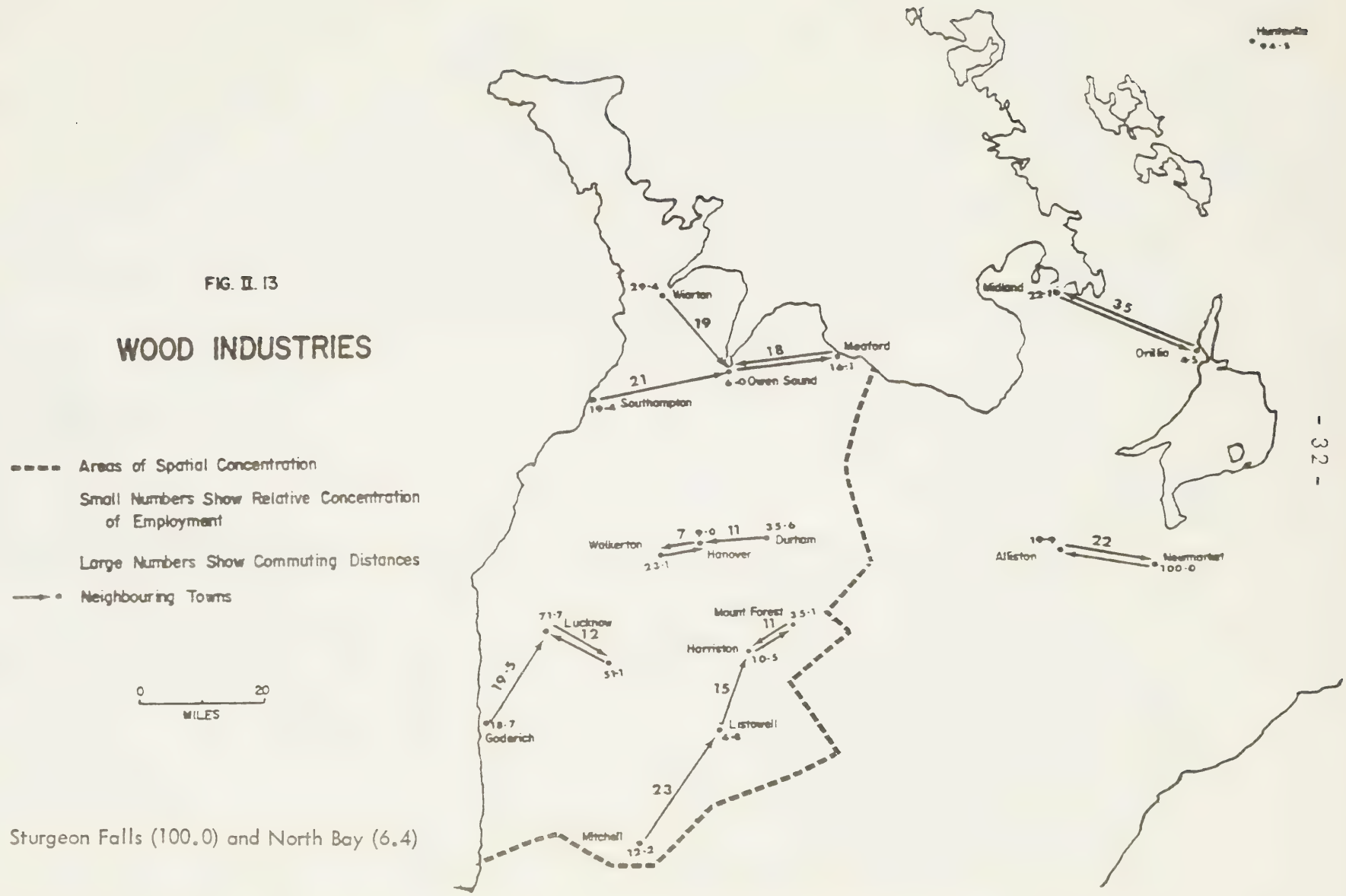
FIG. II. 12

METAL FABRICATING INDUSTRIES

Not shown: North Bay (46.0)

FIG. II. 13

WOOD INDUSTRIES



Not shown: Sturgeon Falls (100.0) and North Bay (6.4)

FIG. II. 14

ELECTRICAL PRODUCTS INDUSTRY

Areas of Spatial Concentration

Small Numbers Show Relative Concentration of Employment

Large Numbers Show Commuting Distances

Neighbouring Towns

0 20
MILES

unit because it is nearer Listowel in highway distance than Walkerton.

After careful consideration, it was decided that three towns (two core points and one outlying center) would be considered the minimum number in delimiting units of spatial concentration, although two interacting core points would be shown as such. Units of spatial concentration then would be grouped into areas of spatial concentration on the basis of contiguous journey-to-work boundaries. An area of spatial concentration may contain one or more units of spatial concentration.

Results. Of the eighteen industries shown in Tables II.2 and II.3, eight displayed spatial concentration in the study under the terms of the three sets of established criteria. These are furniture and fixtures, leather, transportation equipment, chemicals and chemical products, textiles (including knitting and clothing), metal fabricating, wood, and electrical products. These are listed in a declining rank in concentration of study area employment in Table II.4, and are mapped in Figures II.7 to II.14.

Two broad zones of manufacturing concentration emerge from the aggregation of these specialized patterns. One, centred on Walkerton, Hanover, and Durham, is especially important in the output of furniture, wood, and textiles and products. To a recognizable degree, the raw materials for the first two of these industries are local. The other zone, focused on Barrie, Orillia, and Newmarket, is particularly important in output of fabricated metals, chemical products, leather and, although more dispersed, transportation equipment. Except for shipbuilding along the Georgian Bay coast, this zone appears to look more towards Toronto and other Lake Ontario centres for raw materials. One industry, electrical products, displays a concentration along the southern boundary of the study area, more or less centred longitudinally.

Although these patterns may be useful in an evaluation of sector-space relationships in locating manufacturing plants on in evaluating regional

TABLE II.4

Concentration Tendencies of Eight Selected Manufacturing Industries, Georgian Bay Study Area

Industry	Average Linkage Distance (In Highway Miles)	Percent of Total Study Area Employment in Spatial Unit of Concentration
Furniture	15.43	86.62
Leather	17.40	67.14
Transportation equipment	27.05	61.24
Chemical products	26.85	55.55
Textiles, clothing, knitting*	20.50	52.14
Metal fabricating	27.60	42.68
Wood	16.95	41.64
Electrical products	30.25	22.80

* Aggregation of three industries in Table II.3 into a single unit.

Source: Calculated from data gathered in field investigation.

change, they are not very useful in the demarcation of a Georgian Bay Region. First of all, it must be remembered that ten SIC industry classifications did not meet minimum standards for mapping as patterns of concentration. The remaining eight are sufficiently diffuse as to be of questionable value in delimitation, certainly of the southern boundary of the Georgian Bay Region. It is possible, however, that each of the two broad zones may form the core of a sub-region, delimited on an east-west basis (i.e., by means of north-south lines). Such a possibility will be considered further later in this chapter.

Industry Mix by Urban Size Categories

A second possible criterion in manufacturing for delimiting the Georgian Bay Region is the mix of industries by urban size categories, viewed structurally and spatially. A structural mix is shown in Table II.5. Some SIC classifications — notably foods and beverages, leather, wood, furniture and fixtures, fabricated metals, and miscellaneous commodities — are found in urban units of all size groupings. Two, electrical products and chemicals and products, are missing only from the smallest size. Primary metals are not to be seen in the smallest two sizes, printing and publishing in the smallest three, and paper and allied industries in the smallest four. No knitting mills are found in the two largest size categories. Several groupings are not distinctly associated with any specific size category. In summary, structural associations of specified industry types with particular urban size categories are not particularly strong. One may generalize somewhat loosely that the older, traditional industries, particularly when strongly oriented to local markets, tend to be found in all size categories, whereas the newer industries founded on a more recent technology involving metallurgy, electrical products, and chemicals and products tend to be in the larger units. However, the generalization must be stated and accepted cautiously.

Inasmuch as a structural classification offers no possibility of drawing

TABLE 11.5 (on next two pages)

Manufacturing in the Georgian Bay Study Area by
Standard Industrial Classification and Urban Size Categories*

Urban Size (Population)	Number of Centres in Class	Total Manufacturing Employment	Food & Beverage Industries %	Rubber Industries %	Leather Industries %	Textile Industries %	Knitting Mills %	Clothing Industries %	Wood Industries %
1,000 - 1,500	10	794 100	80 10.0		125 15.8		50 6.3	15 1.9	55 6.9
1,500 - 2,500	11	2,077 100	340 16.4	157 7.5	128 6.1			180 8.6	360 17.4
2,500 - 3,500	9	2,194 100	325 14.8		29 1.3		25 1.1	65 3.0	604 27.5
3,500 - 6,000	8	6,096 100	1,032 16.9		335 5.5	610 10.0	15 0.2		485 8.0
6,000 - 12,000	5	6,103 100	435 7.1		475 7.8			185 3.0	198 3.2
12,000 +	3	8,442 100	347 4.1	500 5.9	375 4.4	75 0.9		17 0.2	285 3.4

* The table shows SIC "Major Groupings". Two groupings, Tobacco Products Industries and Petroleum and Coal Products Industries, are not represented in the study area and are omitted. Data pertain to the southern section of the over-all study area plus Bracebridge, Gravenhurst, Huntsville, and Parry Sound. Underscored figures are percentages representing employment in an industry as a per cent of total manufacturing employment in each size category.

Source: Calculated by authors from field data.

Furniture & Fixture Industries %	Paper & Allied Industries %	Printing, Publishing & Allied Industries %	Primary Metal Industries %	Metal Fabricating Industries (Except Machinery & Transportation Industries) %	Machinery Industries (Except Electrical Machinery) %	Transportation Equipment Industries %	Electrical Products Industries %	Non-Metallic Mineral Products Industries %	Chemical & Chemical Products Industries %	Miscellaneous Manufacturing Industries %
112 14.1				118 14.9	15 1.0	199 26.0				25 3.1
656 31.7				46 2.2			35 1.7	36 1.7	19 0.9	120 5.8
204 9.3			110 5.0	131 6.0	20 0.9	173 7.9	120 5.5	11 0.5	150 6.8	227 10.4
881 14.4		165 2.7		500 8.2	650 10.7	565 9.3	360 5.9		263 4.3	235 3.9
888 14.6	20 0.3		135 2.2	713 11.7	400 6.6	1,116 18.3	130 2.1	160 2.6	418 6.9	830 13.6
500 5.9	32 0.4	400 4.7	826 9.7	606 7.2	1,894 22.6	495 5.9	1,460 17.3	41 0.5	216 2.5	373 4.4

a line around a specific region because such a classification is in itself a broad generalization, Table II.5 has not been of marked value in delimiting the Georgian Bay Region. Attempts to map specific urban units with specified industry mixes yielded no more evidence than had been already discovered in the study of concentration of manufacturing (Figures II.7 - II.14).

However, when applied to the concept of attention to alleviation rather than mere identification of economic stress, this approach might be valuable if data were collected for a matrix as broad as, say, Ontario, so that industrial-urban associations could be stated with relative certainty. With such information, it would be possible to recommend that, other things being equal, in a town of a given size that lacks a specific industry or a specific volume of employment in that industry (even though one or more plants may be present), new plants could be located with relative certainty of future successful operation. For at least that new plant, the town in question could become a "growth point".

Commodity Flows

Ideally, the inflow and outflow of commodities to and from manufacturing plants as well as other places of economic production and distribution would be of marked value in regional delimitation. The dominance of certain centres, as well as finer shades of influence among subdominant centres, should be discernible in such flow patterns. However, the major sources of this information in the study area, the transportation companies and associations, have not released such information on a terminal-by-terminal basis, the only basis useful for an area of the size of the Georgian Bay vicinity.

As an alternative, all manufacturing plants interviewed in the study area's southern section (i.e., all plants with employment of 10 or over) were asked to rank their incoming and outgoing products by value, and to specify the initial

break-of-bulk points from which each specified commodity was obtained, or to which it was sent. Responses then were screened to retain only those which specified nearest break-of-bulk centres (instead of initial source areas or ultimate market areas), and then were classified by SIC industrial grouping, and by importance of product (leading, second, third, etc.) as ranked by the firm of interview. Selected flows are shown in Figures II.15 - II.20 by desire lines, with each line representing only the type and direction of flow. No information was gathered as to value and volume of each flow. As shown in Figures II.19 - II.20, the ties from southern Georgian Bay to Toronto, Hamilton, and other Lake Ontario centres appear to be especially numerous, whereas ties to Lake Huron and Georgian Bay are rather few. Figures II.15 - II.18 indicate variations of these ties with selected commodities. In all of the figures, the most important point for delimitation of a Georgian Bay Region is that the maps contain insufficient evidence for the attempt. This type of criterion should be especially valuable in regional delimitation, but the data must be available in detail and for a fine spatial mesh before being used with confidence.

Daily Journey-to-Work Patterns

These patterns are here considered to be essential building blocks in aggregation of meaningful urban-centred regions for alleviating economic stress, inasmuch as they set the outer limits at any given time of a centre's spatial influence in employment. Previous work[4] by the senior author in Ontario has indicated

4. Data have been gathered but not yet published by Richard S. Thoman pertaining to selected N.E.S. areas between Kingston, Ottawa, Montreal, and Three Rivers. These data pertain to daily journey-to-work commuting, considered by occupational structure, size of firm, and total pattern. Manufacturing employment, particularly in Ontario, tends to set the outer limits for the total pattern of employment as revealed in these studies. Major exceptions were found to be construction, which is somewhat ephemeral, and differing services in different places. This study has been financed by grants from the Department of Labour, Ottawa, and the Department of Economics and Development, Province of Ontario.

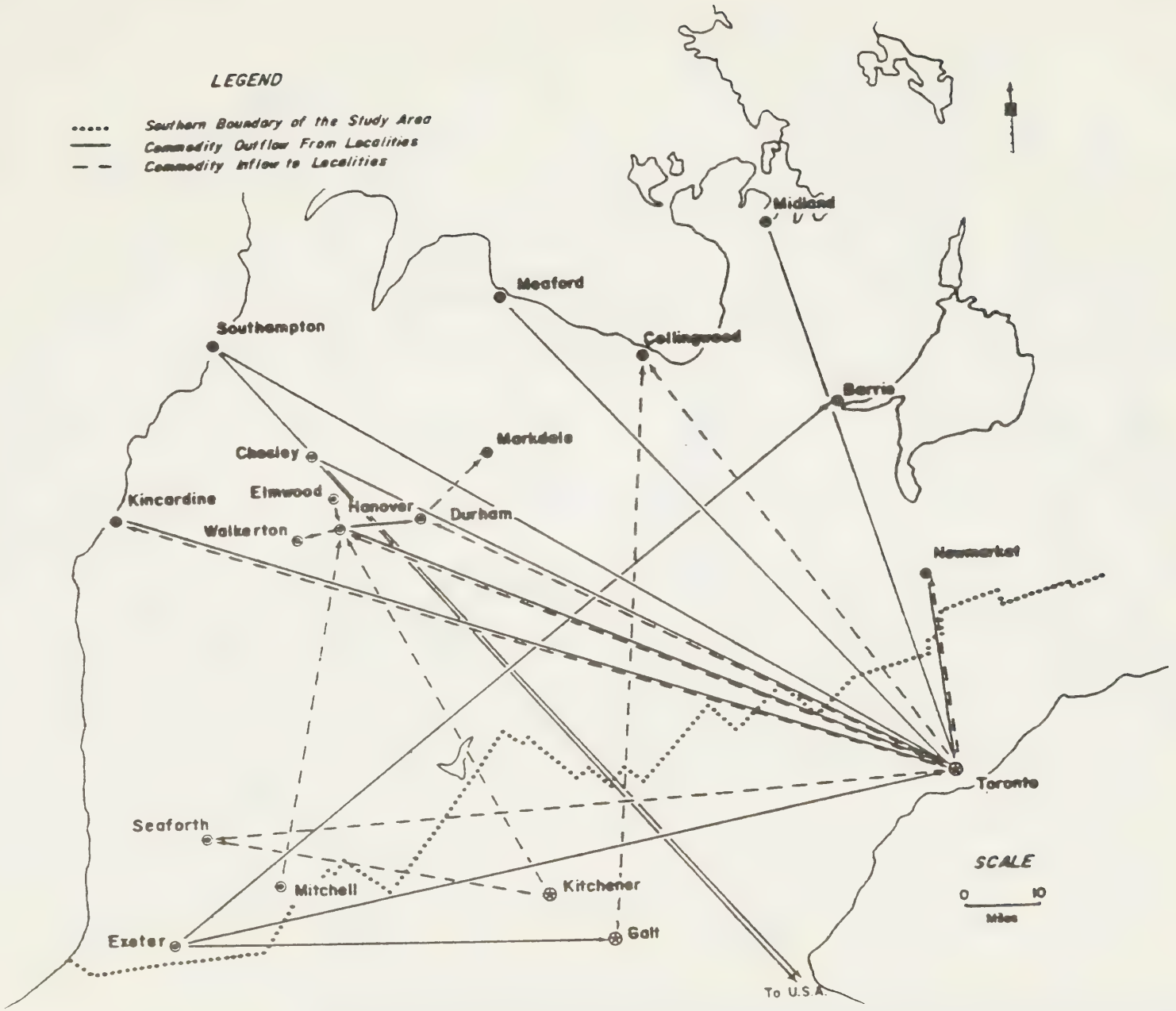


Figure II.15. Inflow and outflow of leading raw materials and products of the furniture and fixtures manufacturing plants of the Georgian Bay study area. Originations and destinations are closest break-of-bulk points. Only commodities are included for which information is definite. Lines indicate movement only, and not value nor volume.

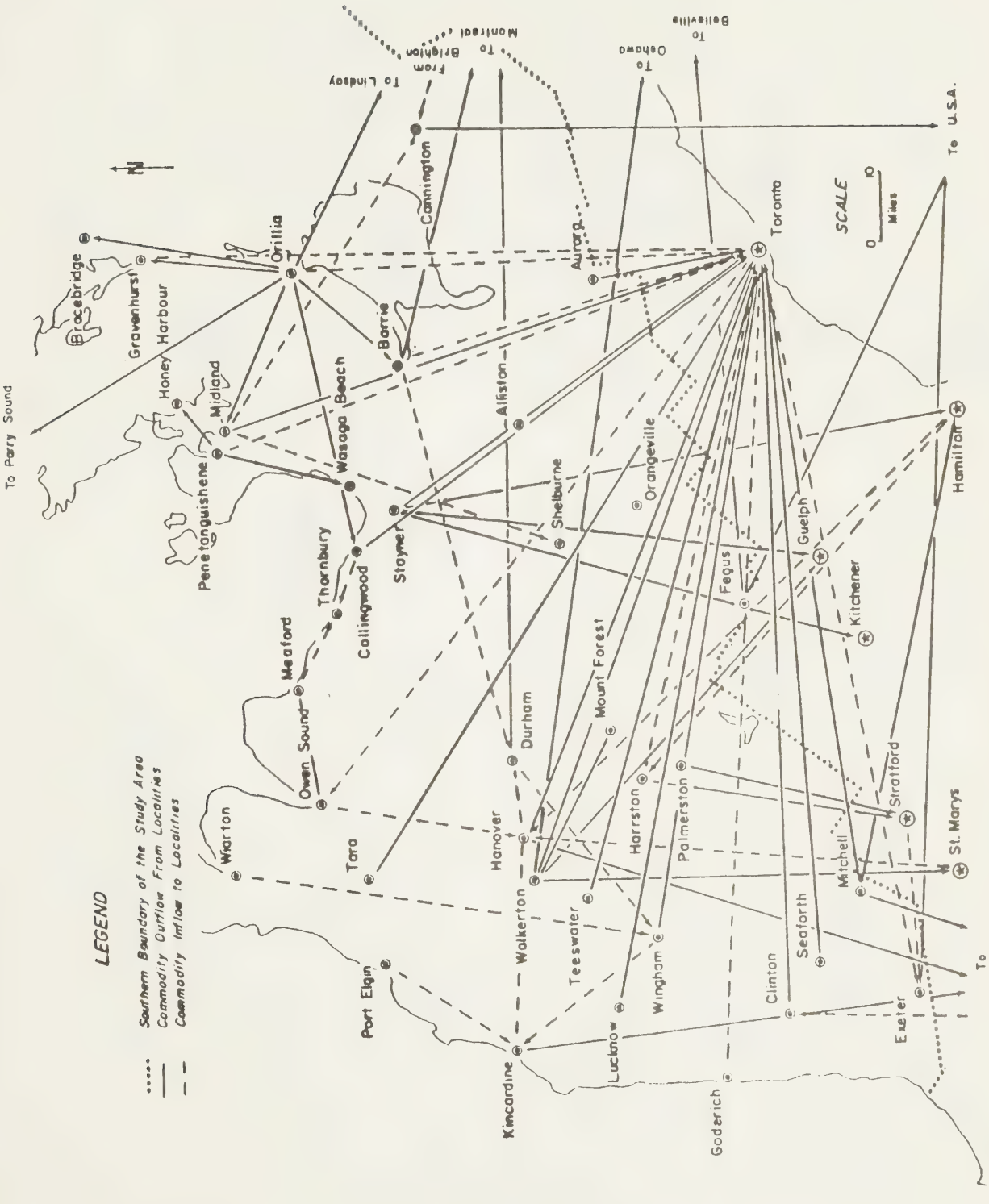


Figure II.16. Inflow and outflow of leading raw materials and products of food and beverage manufacturing plants of the Georgian Bay study area. Originations and destinations are closest break-of-bulk points. Only commodities are included for which information is definite. Lines show movement only, and not value nor volume.

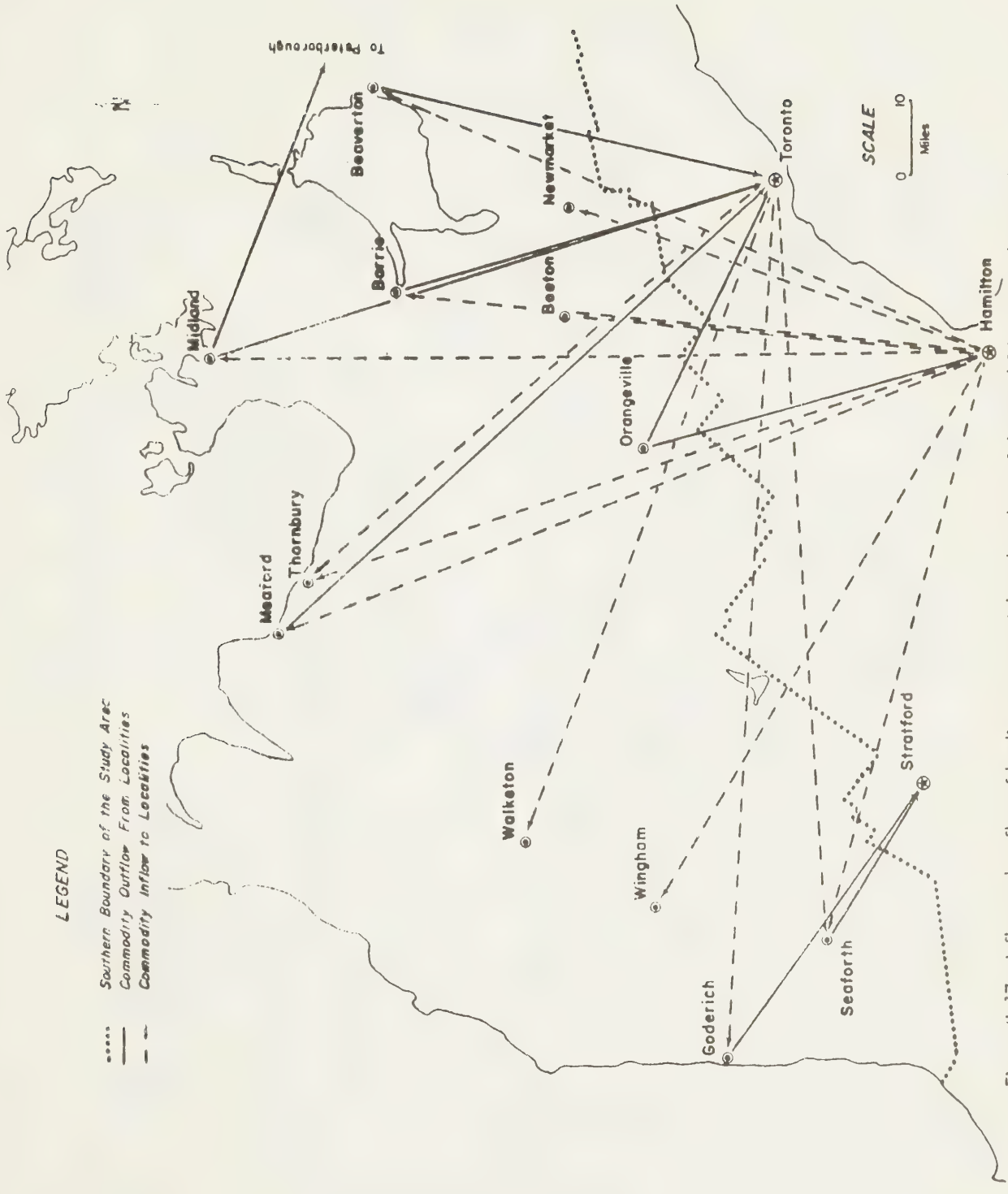


Figure II.17. Inflow and outflow of leading raw materials and products of the metal fabricating plants in the Georgian Bay study area. Originations and destinations are closest break-of-bulk points. Only commodities are included for which information is definite. Lines indicate movement only, and not value nor volume.

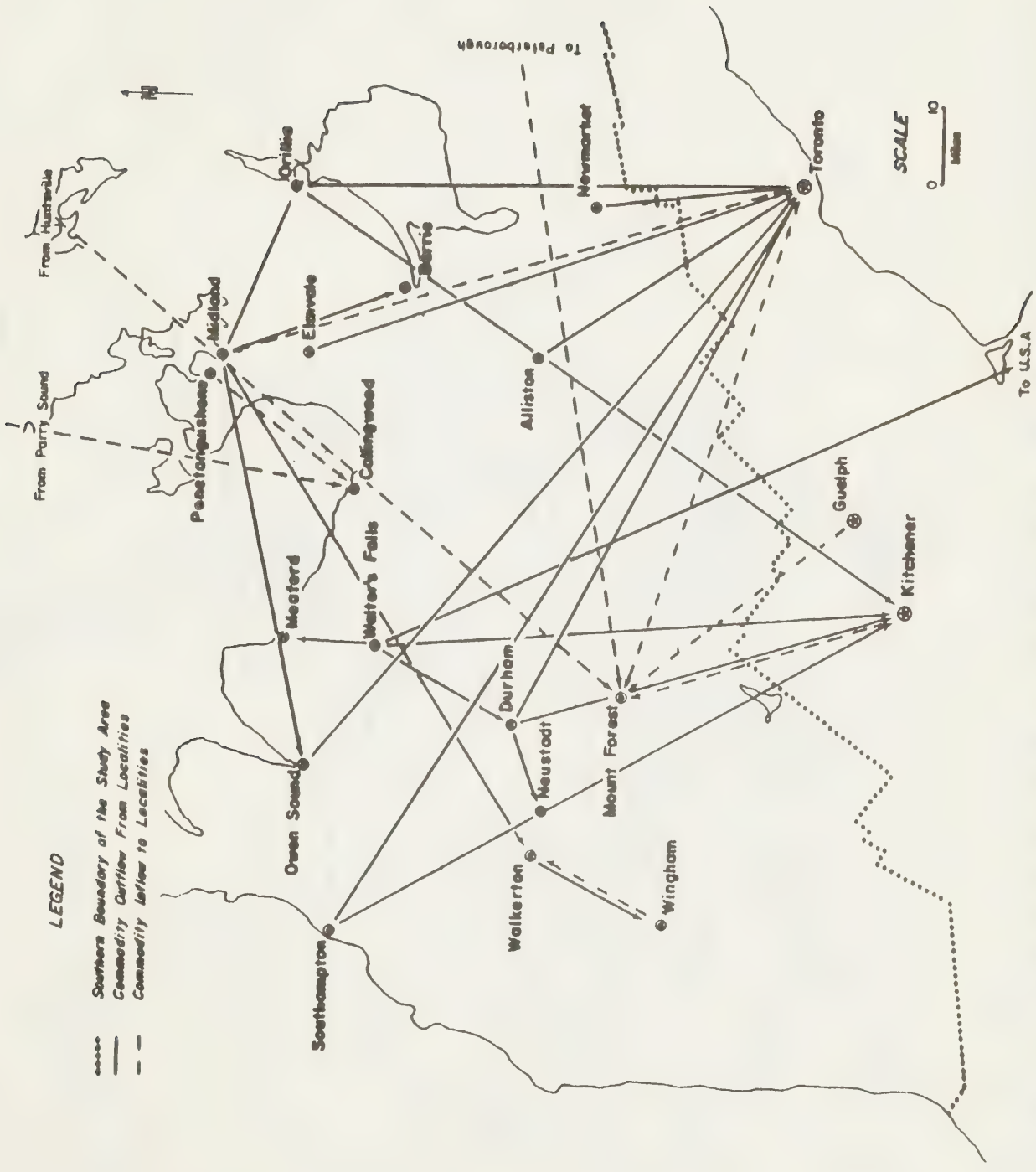


Figure II.18. Inflow and outflow of leading raw materials and products of wood manufacturing plants of the Georgian Bay study area. Originations and destinations are closest break-of-bulk points. Only commodities are included for which information is definite. Lines indicate movement only, and not value nor volume.

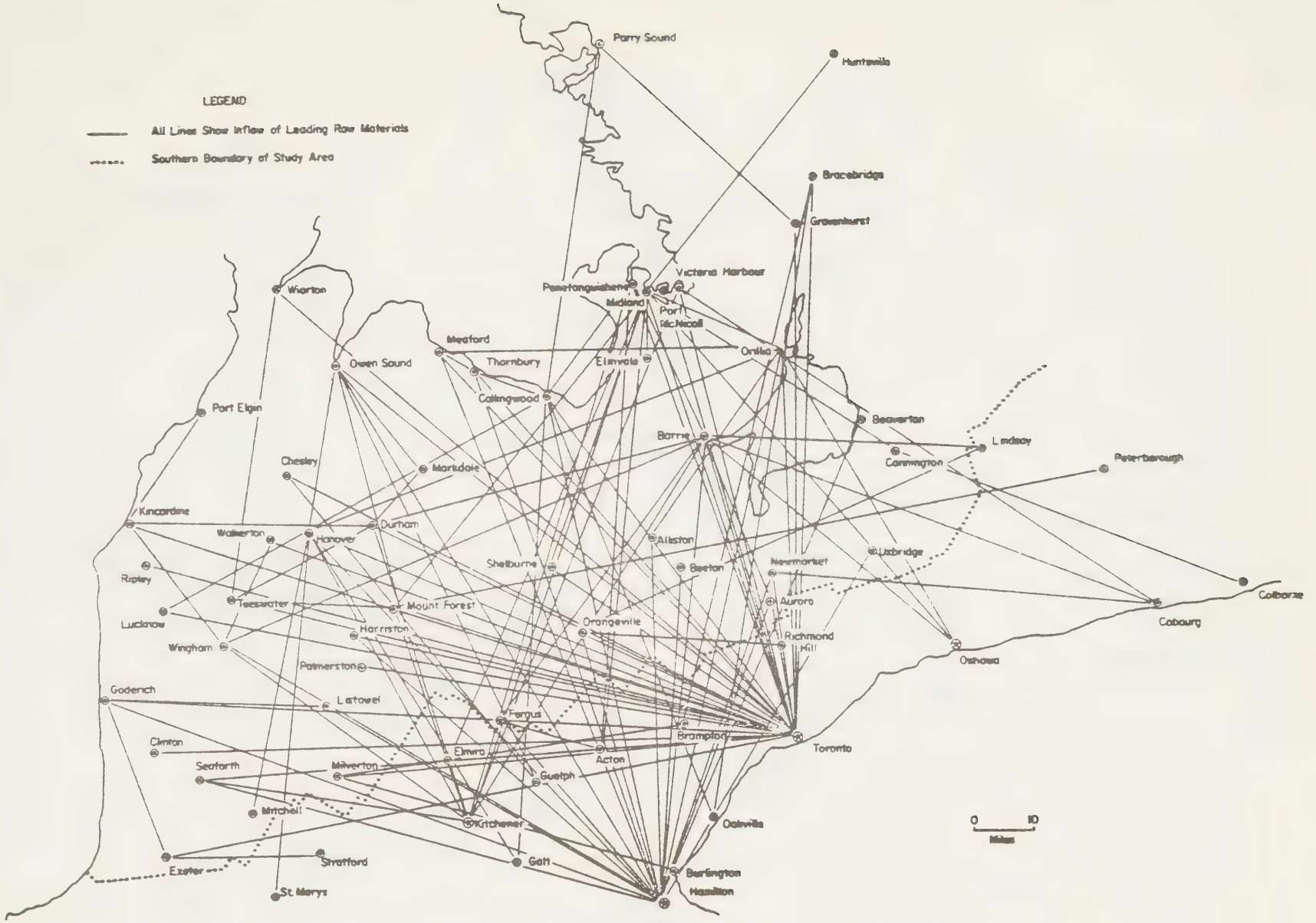


Figure II.19. Inflow of leading raw materials to manufacturing plants in localities of the Georgian Bay study area from closest break-of-bulk points. Only commodities are included for which information is definite. Lines indicate movement only, and not value nor volume.

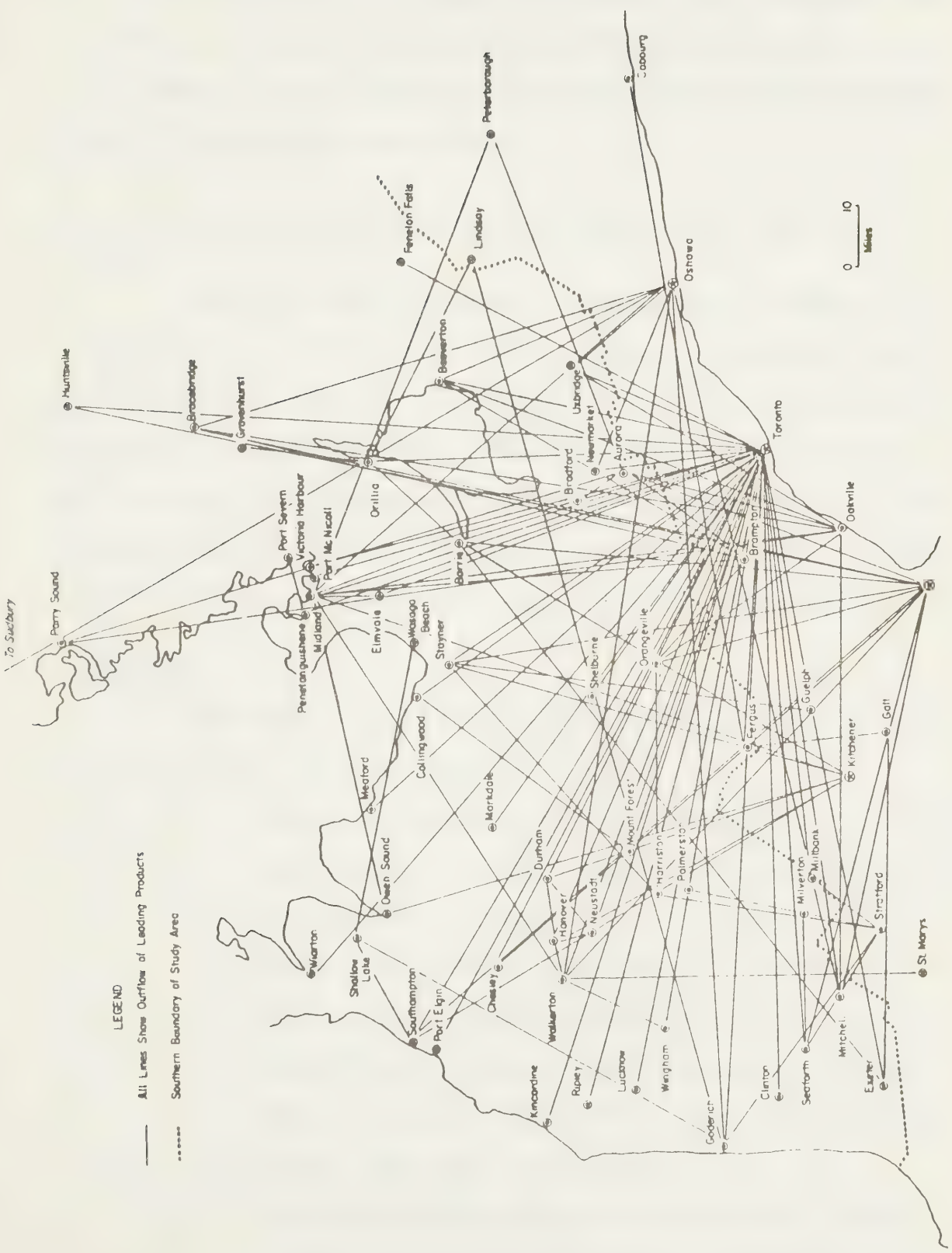


Figure II.20. Outflow of leading products from manufacturing plants in the Georgian Bay study area to closest break-of-bulk points. Only commodities are included for which information is definite. Lines indicate movement only, and not value nor volume.

the outer limits of manufacturing journey-to-work patterns tend to coincide with the outer limits of all journey-to-work patterns. Accordingly, manufacturing journey-to-work patterns in the study area will be treated later in the chapter as representative of all journey-to-work patterns there.

RETAILING AND WHOLESALING AS CRITERIA FOR DELIMITATION

Inasmuch as tertiary activities are increasing sources of employment in Canada (Table II.1), a study of the spatial influence of each classification would be of marked value in delimiting urban-centred regions. Present methodology in urban geography and related fields provides a useful background for examining retail trade and, to a limited degree, wholesale trade. Emphasis therefore will be placed on these two activities as they exist in the Georgian Bay area. It will be noted that trade is an important and growing economic sector in Canada (Table II.1).

Assumptions

The delimitation of the Georgian Bay Region using functional or nodal criteria has to begin with certain assumptions, as follows:

1. The basic assumption concerns the locus of nodes that will be considered to be within the Georgian Bay Region, for a functional region requires the aggregation of areas to nodes. The nodes selected as being within a Georgian Bay Region (whatever are its limits) are urban places located along the coast line of the Georgian Bay. The concern therefore becomes the relationship between the functional regions of these nodes and the functional regions of other nodes in southern Ontario.
2. The second assumption concerns the types of economic activity, or criteria, to be used for the definition of the functional region.

Inasmuch as tertiary activities (service industries) are essentially urban located, the only way in which the geography of tertiary activity can be rationally analysed is in the framework of the functional region which, in this sense, involves city-region service relationships of retail and wholesale activities.

Basic Definitions

A considerable body of information has been developed concerning the geography of tertiary activity, much of which revolves around a discussion of central place theory. As with any body of theory there are certain terms which have specific meanings and which need to be defined. These are defined below:

Central place — a place (location) which is a source of goods and services for an area larger than itself.

Function — a type of service activity, such as a barber shop, a grocery store, or a stockbroker.

Establishment — a service unit of any type, such as a barber shop, a grocer, and a stockbroker. Thus a given functional type may be represented by a number of establishments (stores or shops). As a consequence the range of services available in a central place is represented by the number of functions, not the number of establishments, found in a central place.

Threshold — indicates the minimum demand required to support one establishment of a functional type. As people require services, this demand is represented by purchasing power. However, purchasing power data, as measured by income of individuals, is extremely difficult to obtain at the very low level of aggregation required for this study. Therefore, the operational definition of "threshold" becomes the minimum number of people required to support one function.

Hierarchy — any study of a system of central places assumes the

existence of a hierarchy of central places. An assumption of this kind involves the notion that there are many small central places providing functions which are in frequent demand and which serve limited areas, plus fewer, but larger, central places providing not only those services that are frequently demanded, but also those that are infrequently demanded and require larger service area. The concept of an hierarchy is, therefore, intrinsically spatial and need not necessarily be observed in the aggregate as in a graph where the concomitant existence of a continuum is bound to be emphasized.

Some Recent Classifications of Central Places in North America

There have been a number of studies undertaken in North America concerning central places and numerous attempts at classifying central places according to their service importance. This brief survey will present part of the results of three very recent studies that are of interest as far as this report is concerned.

The Berry study of central places in 1960 in southwestern Iowa was conducted in an area where the population density was about 15.5 persons per square mile[5]. In this area, four classes of central places were discerned, and some characteristics of these are presented in Table II.6. The range of the characteristics are in discrete classes because the data has been extracted from Berry's graphs.

A study by Borchert and Adams of 2,200 central places in the Upper Midwest dealt with a far greater range of size of central place, as well as a much greater area, than that studied by Berry[6]. The Borchert and Adams study area

5. Berry, B.J.L., et al., "Retail Location and Consumer Behaviour", Papers and Proceedings of the Regional Science Association, 9:65-106 (1962).

6. Borchert, J. R., and R. B. Adams, Trade Centers and Trade Areas of the Upper Midwest. Upper Midwest Economic Study, Urban Report No. 3 (1963).

TABLE II.6

A Classification of Central Places in Southwestern Iowa

Class of Central Place	Range in Number of Central Functions	Range in Number of Establishments	Range in Population of Central Place
Hamlets	1- 8	1- 10	10- 170
Villages	8- 26	10- 45	170- 400
Towns	26- 55	45-120	400-1,700
Cities	55-100 (approx.)	120-400 (approx.)	1,700-9,000

Source: B. J. L. Berry, see footnote 5.

included the states of Montana, N. Dakota, S. Dakota, Minnesota, as well as northern Iowa, northwest Wisconsin, and the upper Michigan peninsula. In this area, eight classes of central places were discerned, and these are presented in Table II.7. Because of the way in which the data are presented, it is difficult to make a comparison between the Borchert and Adams classification and the Berry classification of central places. This is made even more difficult by the fact that the source of data for the Borchert and Adams study was Dun and Bradstreet Directories, which do not include all service functions found in central places, whereas the Berry study involved quite intensive field work.

However, Hodge, in a study of trade centre viability in southern Saskatchewan from 1941-61, also used Dun and Bradstreet Directories as well as adopting the Borchert and Adams nomenclature[7]. The Hodge classification and characteristics are summarized in Table II.8.

Probably the most interesting part of the Hodge study is that he uses the classification of central places in 1941 and 1961 to develop a matrix of probabilities that, in effect, summarize trade centre viability in southern Saskatchewan (Table II.9). This table indicates that 46% of all hamlets in 1941 expired (ceased to exist) by 1961, 52% still provided hamlet-level functions, and 2% grew to be minimum convenience centres. Thus, if these same probabilities pertain for trade centre viability between 1961 and 1981, there is a good chance that nearly a half of the hamlets now in existence in this part of the Great Plains will have expired. Therefore, the Hodge study raises vital issues concerning planning for settlement growth (or obsolescence) by pin-pointing those classes of central place that are of the greatest concern.

---

7. Hodge, G., "The Prediction of Trade Centre Viability in the Great Plains", Papers and Proceedings of the Regional Science Association, 15:87-118 (1965).

TABLE II.7

A Classification of Central Places in the Upper Midwest

Class of Central Place	Average Number of Central Functions	Range of Wholesale Establishments	Range in Population of Central Place	Median Population of Central Place
Hamlets	6.0		30-1,800	160
Minimum convenience	14.4		300-3,700	800
Full convenience	27.7		800-3,600	1,600
Partial shopping	35.8		1,200-8,700	2,500
Complete shopping	45.6	50-100	3,700-27,900	9,500
Secondary wholesale-retail			23,100-79,700	42,400
Primary wholesale-retail		100-500	65,200-193,000	71,700
Metropolitan wholesale-retail		500 and above	1,525,300	

Source: J. R. Borchert and R. B. Adams, see footnote 6.

TABLE 11.8

A Classification of Central Places in Southern Saskatchewan

Class of Central Place	Average Number of Establishments	Range of Population of Central Place	Median Population of Central Place
Hamlets	3.3	30-300	50
Minimum convenience	9.9	80-700	210
Full convenience	16.5	200-1,600	360
Partial shopping	26.1	300-1,400	610
Complete shopping	58.5	900-4,000	1,800
Secondary wholesale-retail	232.0	5,200-33,200	10,000
Primary wholesale-retail	1,414.0	95,500-112,100	103,800

Source: G. Hodge, see footnote 7.

TABLE II.9

Changes in the Proportion of Trade Centres Among Classes, Saskatchewan, 1941-61
Class of Center in 1961

Class of Center 1941	Expired by 1961	Hamlet	Min. Conv.	Full Conv.	Part Shop.	Comp. Shop.	Sec. W-R	Prim. W-R
New Center (1942-51)	48	52						
Hamlet	46	52	02					
Min. Conv.	02	63	27	07	01			
Full Conv.		6	28	39	26	01		
Part. Shop.			02	19	63	16		
Compl. Shop.					12	73	15	
Secondary W-R							100	
Primary W-R								100

Source: G. Hodge, see footnote 7.

A Retail Delimitation of the Georgian Bay Area

Classification of Central Places in the Study Area. The method used for classifying centres, in the southern section of the Georgian Bay study area, (Figure II.2) is basically that followed by Berry in the study mentioned above. This methodology has been chosen because it provides a logical base for classification in as objective a framework as possible.

Three relationships are developed for classifying centres using data obtained from direct field work, telephone directories, city directories and the 1966 Ontario Municipal Directory. The first is the relationship between the population of a central place and the number of establishments in a central place. Figure II.21 illustrates a very close positive relationship between the population of a central place and the number of establishments found in a central place when both variables are transformed into common logarithms. The arithmetic version of this relationship is indicated by the solid black line in Figure II.22.

The second relationship is that between the population of a central place and the number of functions found in a central place. Figure II.23 indicates that there is a close positive relationship between these two variables when population is transformed into common logarithms. The arithmetic representation of this relationship (the solid black line in Figure II.24) indicates that the number of functions found in a central place increases at a decreasing rate as the population of a central place increases.

Thus, it would be expected that the relationship between establishments and functions is also curvilinear. Figure II.25 indicates that there is a strong positive relationship between the number of establishments (transformed into common logarithms) and the number of functions found in a central place. The arithmetic version of the least-squares line of best fit in Figure II.25 is drawn as a solid black line in Figure II.26, which suggest that the number of establishments found in a

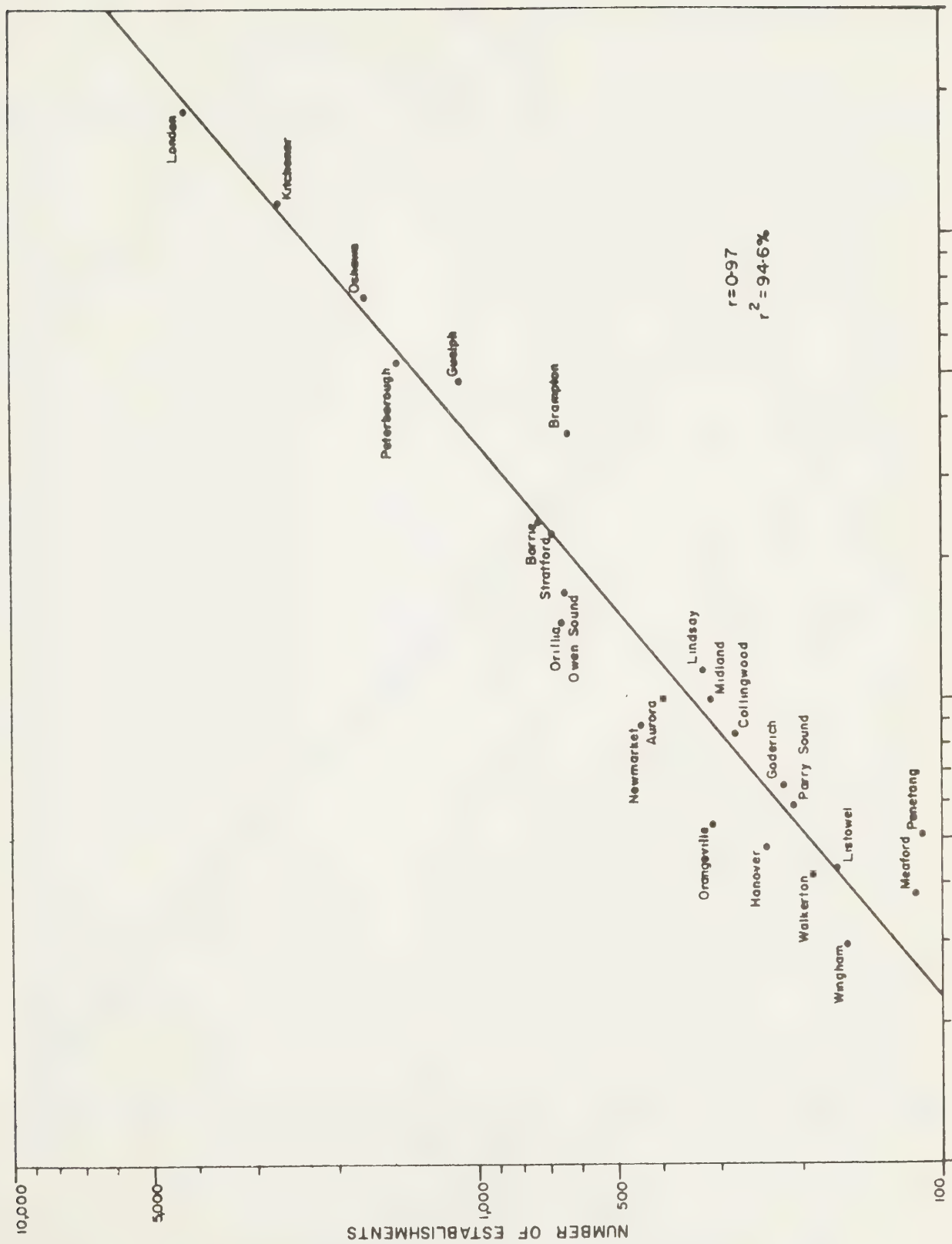

NUMBER OF ESTABLISHMENTS
10,000
5,000
1,000
500
100
1,000
5,000
10,000
50,000
100,000
TOTAL POPULATION
r=0·97
r²=94·6%
London
Kitchener
Oshawa
Peterborough
Guelph
Brampton
Barrie
Stratford
Orillia
Owen Sound
Lindsay
Midland
Collingwood
Goderich
Parry Sound
Listowel
Meaford
Penetang
Wingham
Walkerton
Hanover
Orangeville
Newmarket
Aurora

FIG. II. 21

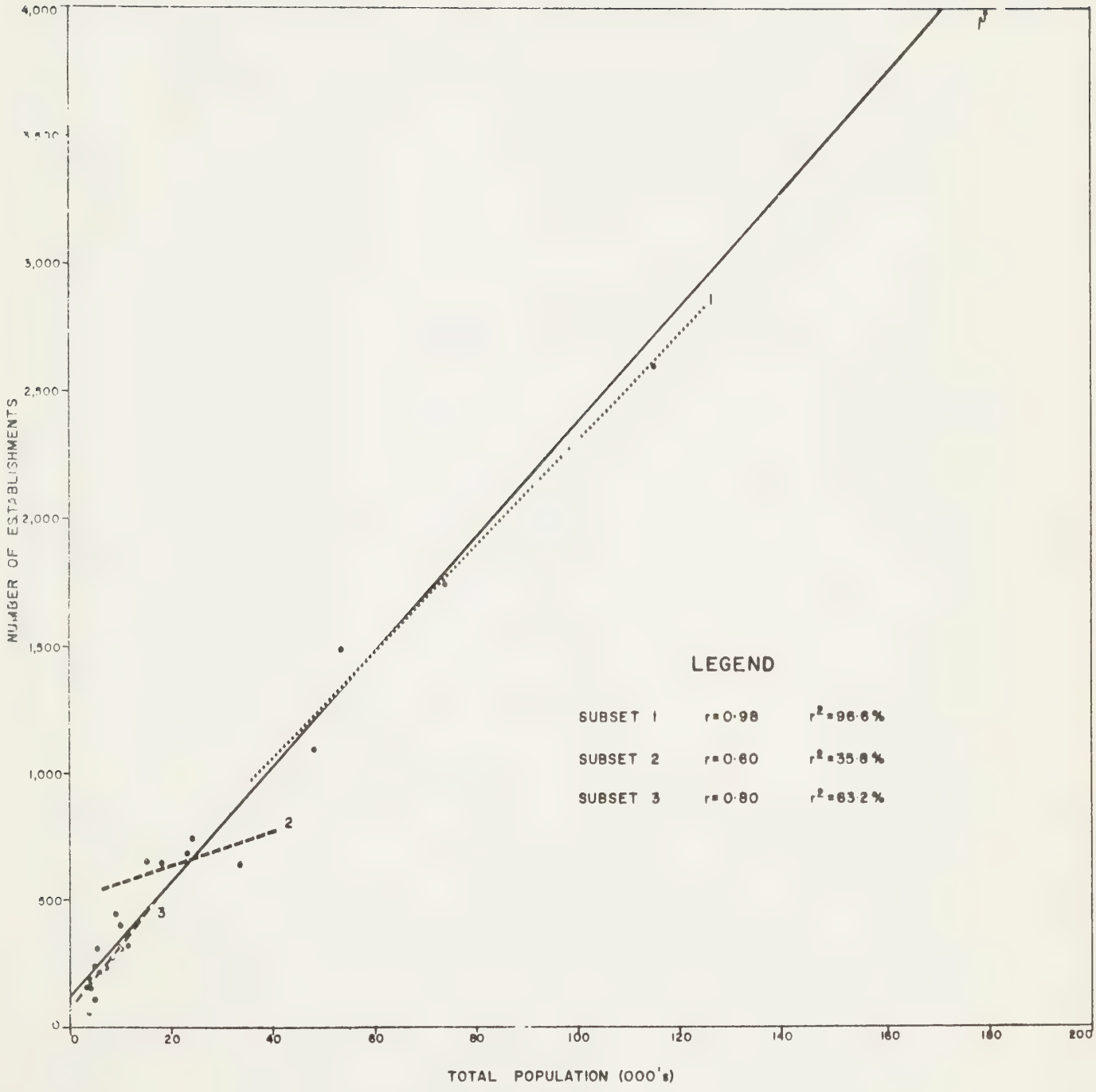

4,000
3,000
2,500
2,000
1,500
1,000
500
0
NUMBER OF ESTABLISHMENTS
0
20
40
60
80
100
120
140
160
180
200
TOTAL POPULATION (000's)
LEGEND
SUBSET 1 r=0·98 r²=96·6%
SUBSET 2 r=0·60 r²=35·8%
SUBSET 3 r=0·80 r²=63·2%
1
2
3

FIG. II. 22


NUMBER OF FUNCTIONS
TOTAL POPULATION
0
20
40
60
80
100
120
140
160
180
200
1,000
5,000
10,000
50,000
100,000
London
Kitchener
Oshawa
Peterborough
Guelph
Barrie
Orillia
Stratford
Newmarket
Owen Sound
Brampton
Hanover
Orangeville
Aurora
Midland
Collingwood
Walkerton
Parry Sound
Lindsay
Listowel
Penetang
Goderich
Meaford
r=0·88
r²=77·8 %

FIG. II. 23

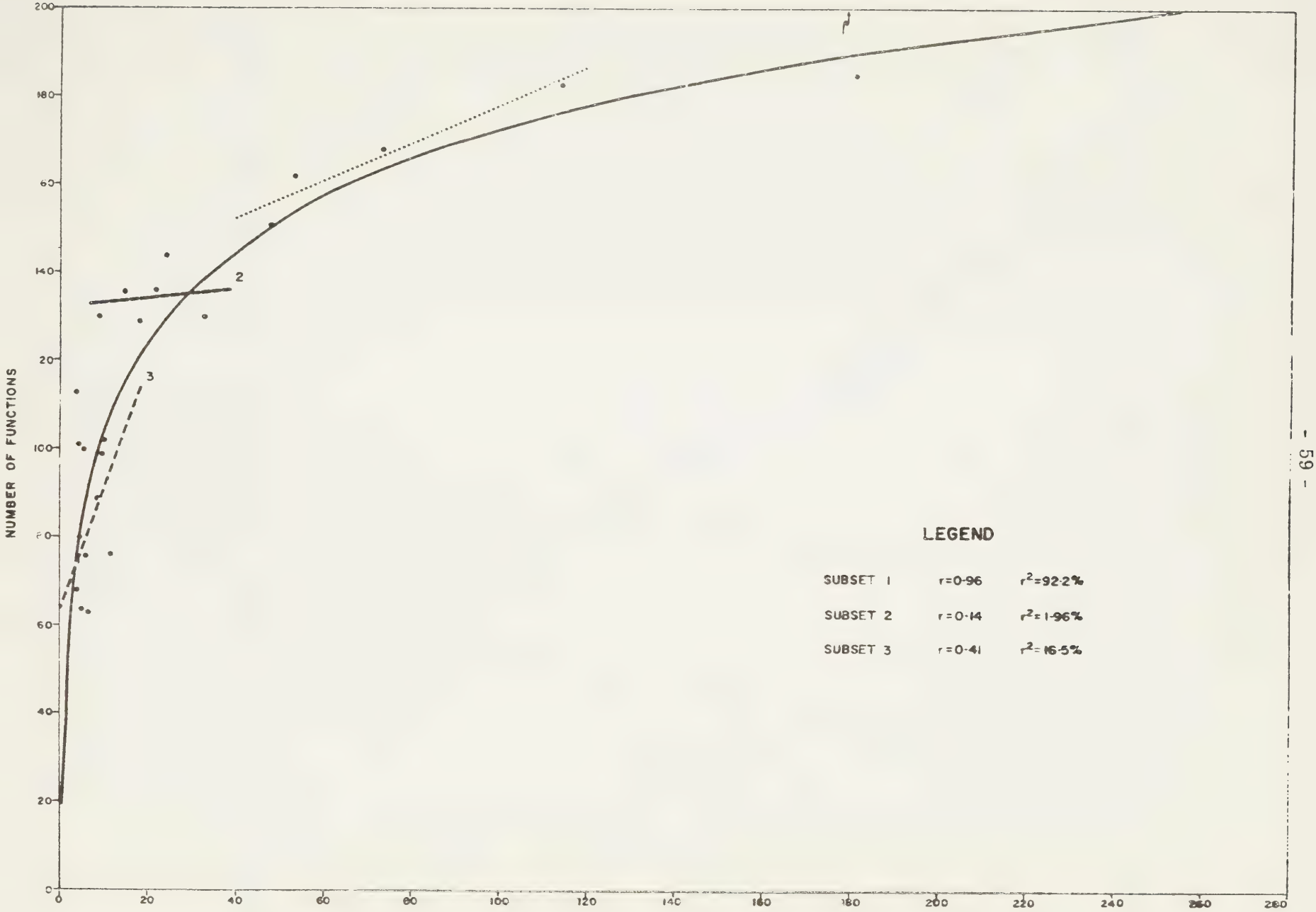
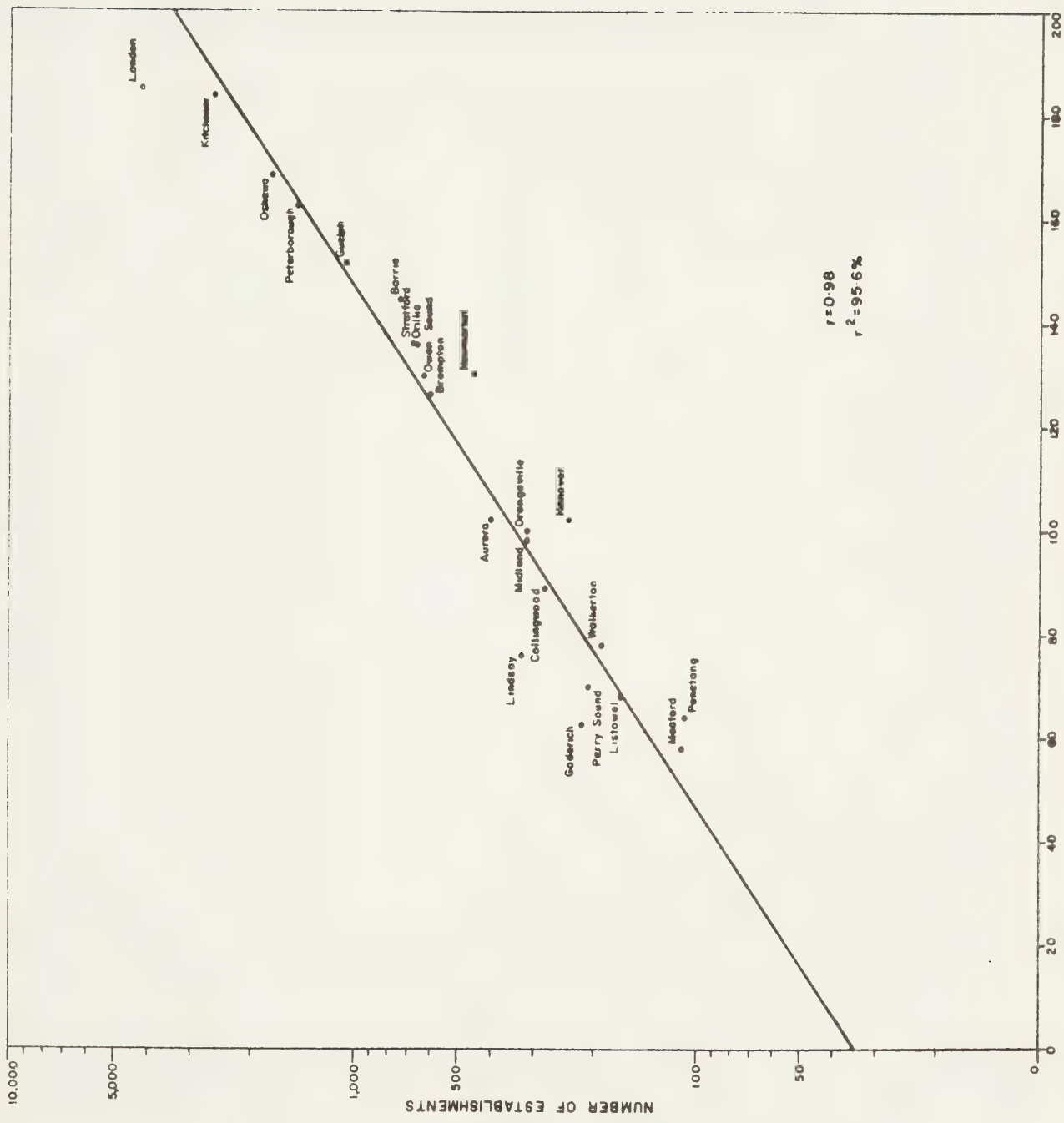

NUMBER OF FUNCTIONS
TOTAL POPULATION ('000's)
LEGEND
SUBSET 1 r=0·96 r²=92·2%
SUBSET 2 r=0·14 r²=1·96%
SUBSET 3 r=0·41 r²=16·5%
2
3

FIG. II. 24


NUMBER OF ESTABLISHMENTS
10,000
5,000
1,000
500
100
50
0
20
40
60
80
100
120
140
160
180
200
NUMBER OF FUNCTIONS
r=0·98
r²=95·6%
London
Kitchener
Oshawa
Peterborough
Guelph
Barrie
Stratford
Orillia
Owen Sound
Brampton
Newmarket
Aurora
Orangeville
Midland
Hanover
Collingwood
Wolkerton
Lindsay
Goderich
Perry Sound
Listowel
Meaford
Penetang
FIG. II.25

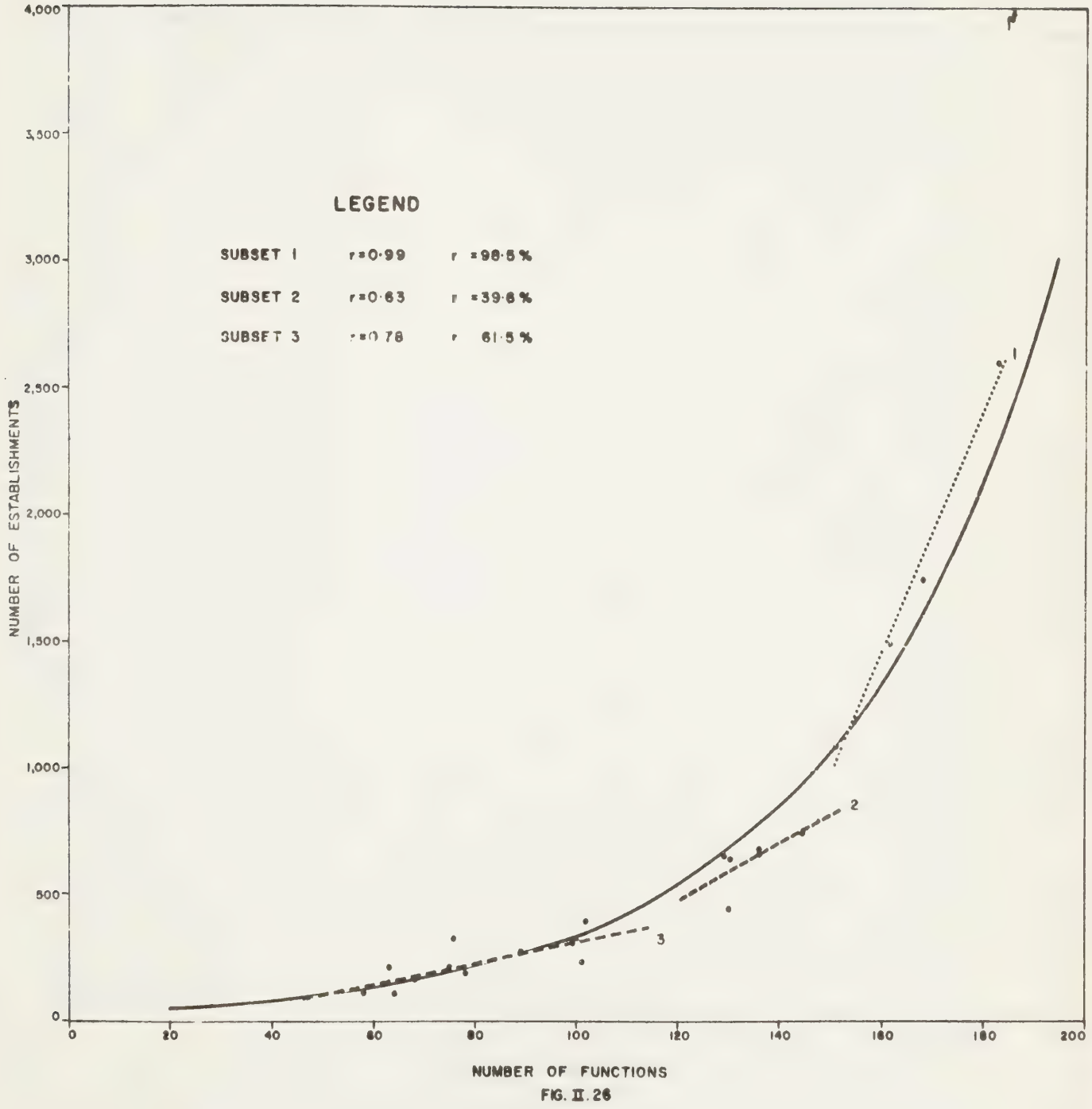

LEGEND
SUBSET 1 r=0·99 r²=98·5%
SUBSET 2 r=0·63 r²=39·6%
SUBSET 3 r=0·78 r² 61·5%
NUMBER OF ESTABLISHMENTS
NUMBER OF FUNCTIONS
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
20
40
60
80
100
120
140
160
180
200
1
2
3

FIG. II.26

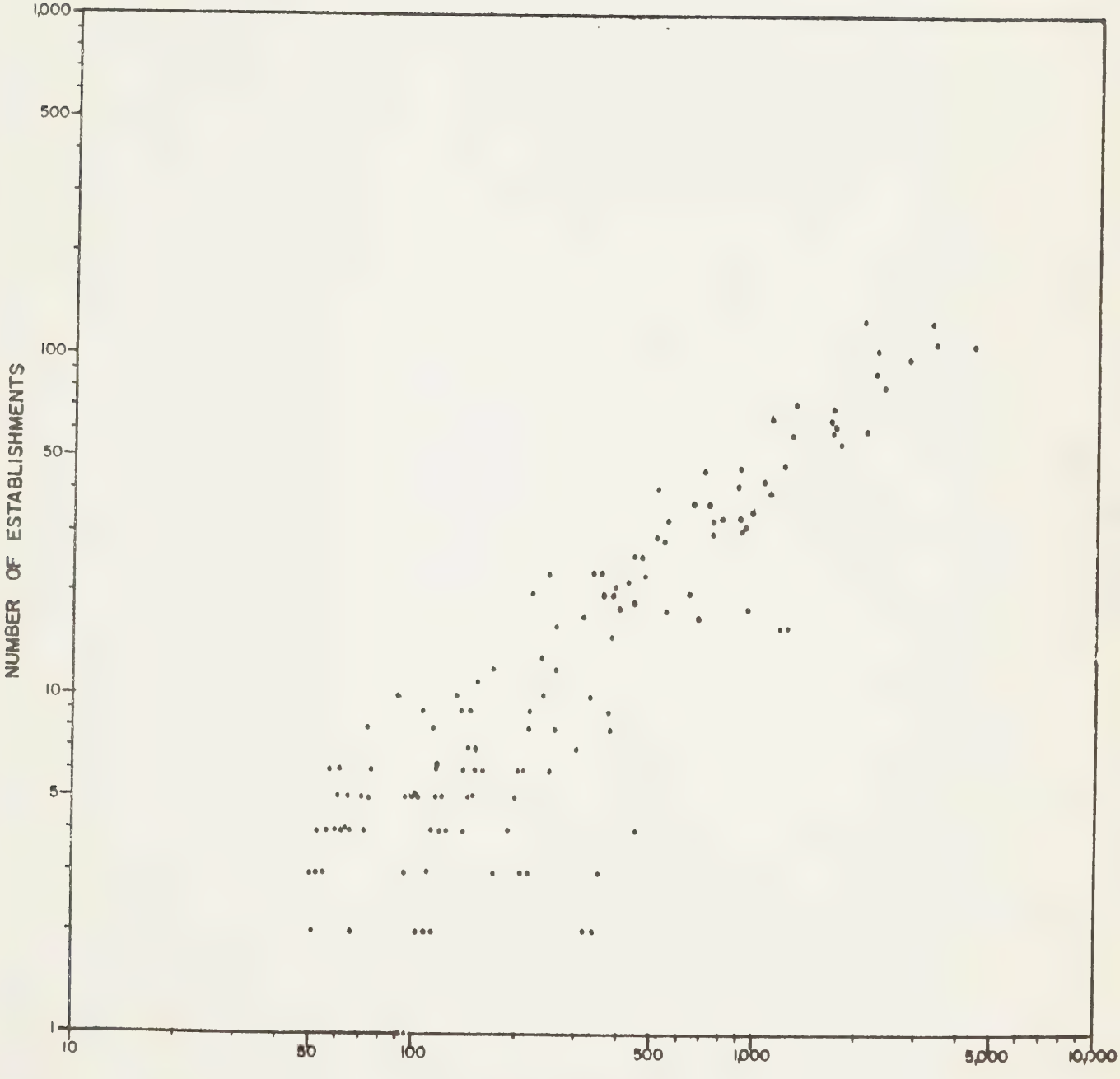

1,000
500
100
50
10
5
1
NUMBER OF ESTABLISHMENTS
10
50
100
500
1,000
5,000
10,000
TOTAL POPULATION

FIG. II.27

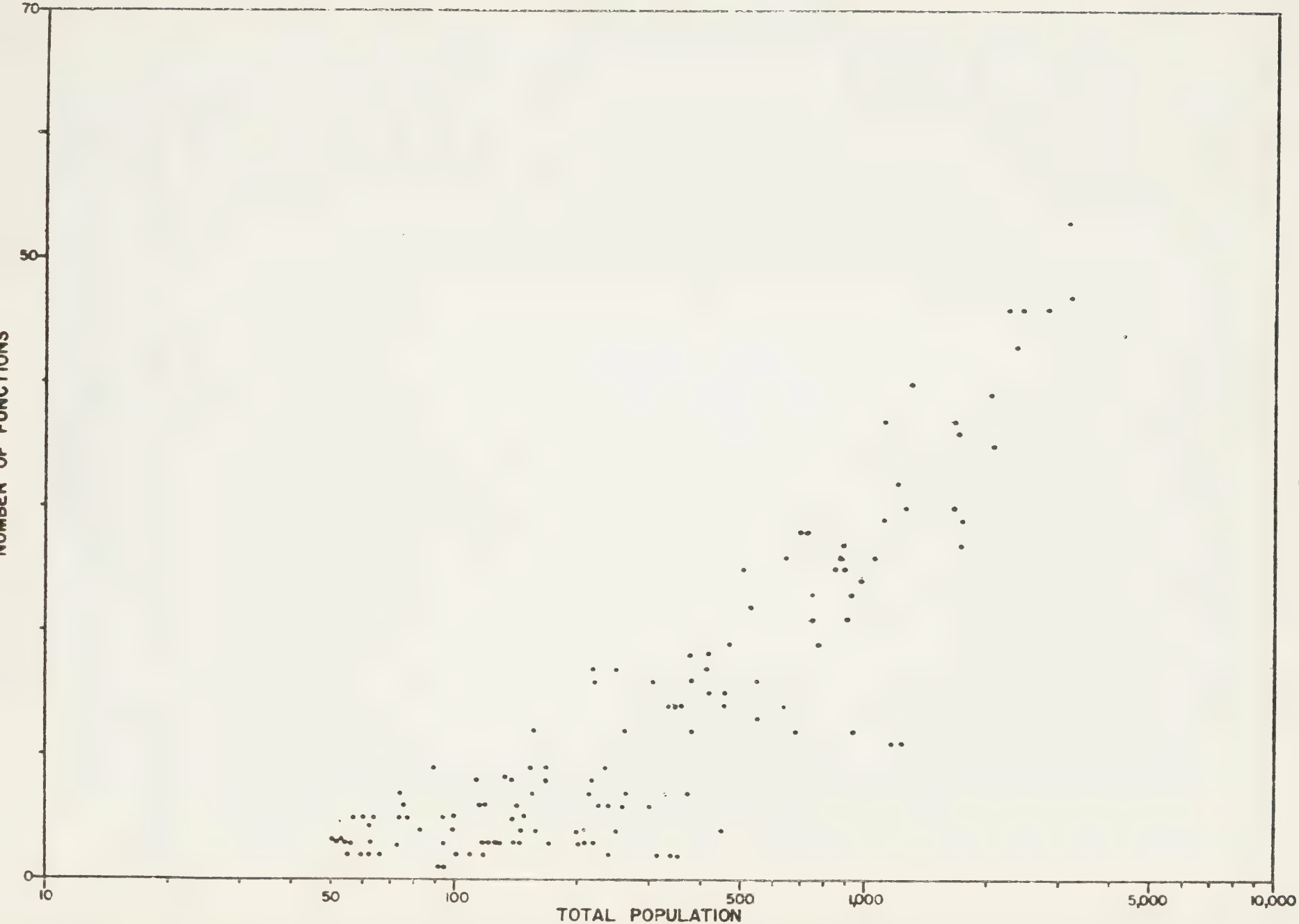

70
50
0
NUMBER OF FUNCTIONS
10
50
100
500
1,000
5,000
10,000
TOTAL POPULATION

FIG. II. 28

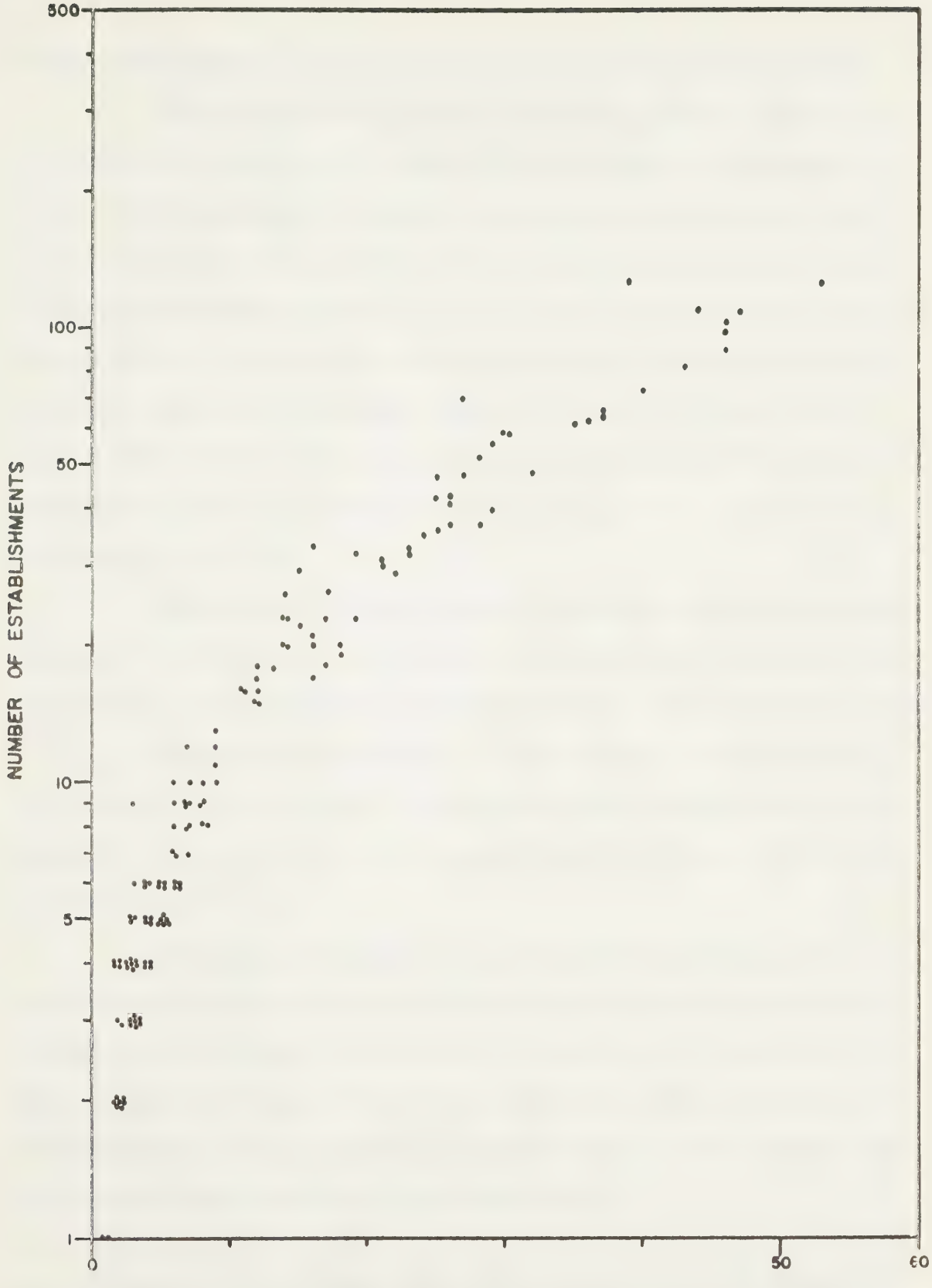

500
100
50
10
5
1
0
50
60
NUMBER OF ESTABLISHMENTS
NUMBER OF FUNCTIONS

FIG. II. 29

central place increases at an increasing rate with the proliferation of functions.

This last relationship is the basic relationship used for classifying central places in the study area. The number of functions found in a central place is the key to the importance of that place in the service hierarchy because it represents the range of services available. The establishment variable is simply a size index, as is indicated by Figure II.21 and II.22. The distinct clusters of scattered points in Figure II.25 can be regarded as manifestations of the existence of such a hierarchy, and the clear discontinuity presented by subset 2 in Figure II.26 is further evidence of hierarchical sub-groupings along a continuum. Furthermore, subset discontinuities of this kind for the same groupings of towns are also apparent in Figure II.22 and II.24.

Using data for 167 central places (the small centre data are presentation Figures II.27 to II.29), and a classificatory methodology such as that outlined above, a hierarchy has been developed for the Georgian Bay area. This is presented in Table II.10. As a collaboration of this analysis it is important to note that Heidenreich developed a similar classification of central places, using the same methodological approach as that used in this study, in an area substantially the same as that investigated in this report[8].

Field Research Procedures for Determing Retail Hinterlands. The retail hinterlands were constructed differently in the two major areas of population density. In the less dense northern area the hinterlands were constructed by interviewing in retail stores within the town, and, where possible, by using recent research studies. In the more densely populated southern area the boundaries were constructed by sample interviewing over the whole area.

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8. Heidenreich, C. E., A Study of Function and Form in Business Districts of Some Small Urban Centres in Southern Ontario. (Unpublished M.A. Thesis, University of Toronto, 1964).

TABLE II.10

A Classification of Central Places in the Georgian Bay Area

Class of Central Place	Range in Number of Central Functions	Range in Number of Establishments	Range of Wholesale Firms	Range in Pop. of Central Place
Hamlets	1-9	1-14		50-460
Minimum convenience (villages)	9-24	14-36		220-1,300
Full convenience (towns)	24-50	36-128	Usually 1	1,100-4,200
Partial shopping (cities)	50-110	128-420	1-3	3,100-10,000
Complete shopping (sub-regional centres)	110-150	420-800	3-10	9,000-35,000
Secondary wholesale-retail (regional centres)	150-185	800-3,000	10-50	47,000-120,000
Primary wholesale-retail (sub-provincial centres)	185 +	3,000 +	50 +	150,000 +
Metropolitan wholesale-retail (provincial capital				

Source: Evaluation of field data.

In order to achieve complete spatial coverage, a systematic-stratified sample was used in the southern zone. The area was divided into cells combining four survey sections, the boundaries of which were defined by section lines or concession roads. This latter procedure also facilitated interviewer mobility — a factor not to be lightly considered in geographic space. The resultant distribution of the 1,760 sample interviews is presented in Figure II.30.

From the definition of thresholds alone it would seem possible to select a range of functions appropriate to particular levels of central places and use these as direct questions in a questionnaire. The functions were selected in the light of information that can be gleaned from studies by Berry and Ray[9], and are as follows: opticians, dentists, female clothing, lawyers, banks, work clothes (general apparel), food stores, and garages.

An estimation of the threshold population for each one of these functions (Figures II.31 - II.38) indicates that garages, food stores, and general clothing can be found in all classes of central places, including hamlets. The general store which serves all these functions is typical of hamlets in this part of Canada, and so therefore these three functions can be regarded as typical hamlet-level functions (Figure II.39) and can be used to delimit hamlets.

Lawyers offices and banks are found in all classes of central places except hamlets, (Figure II.39) and their threshold population values indicate that they are typically found in middle sized villages, even though their offices are commonly open only two or three days in the week. In the larger villages, banks in particular will be open each weekday. Therefore the hinterland of banks and lawyers can be used as a primary delimitation of villages.

Female clothing stores are found in all towns (Figure II.39), dentists

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9. Berry, B.J.L., op cit; Ray, D.M., Urban Growth and the Concepts of a Functional Region. Ottawa; Sparton Air Services, 1966 (Xerox).

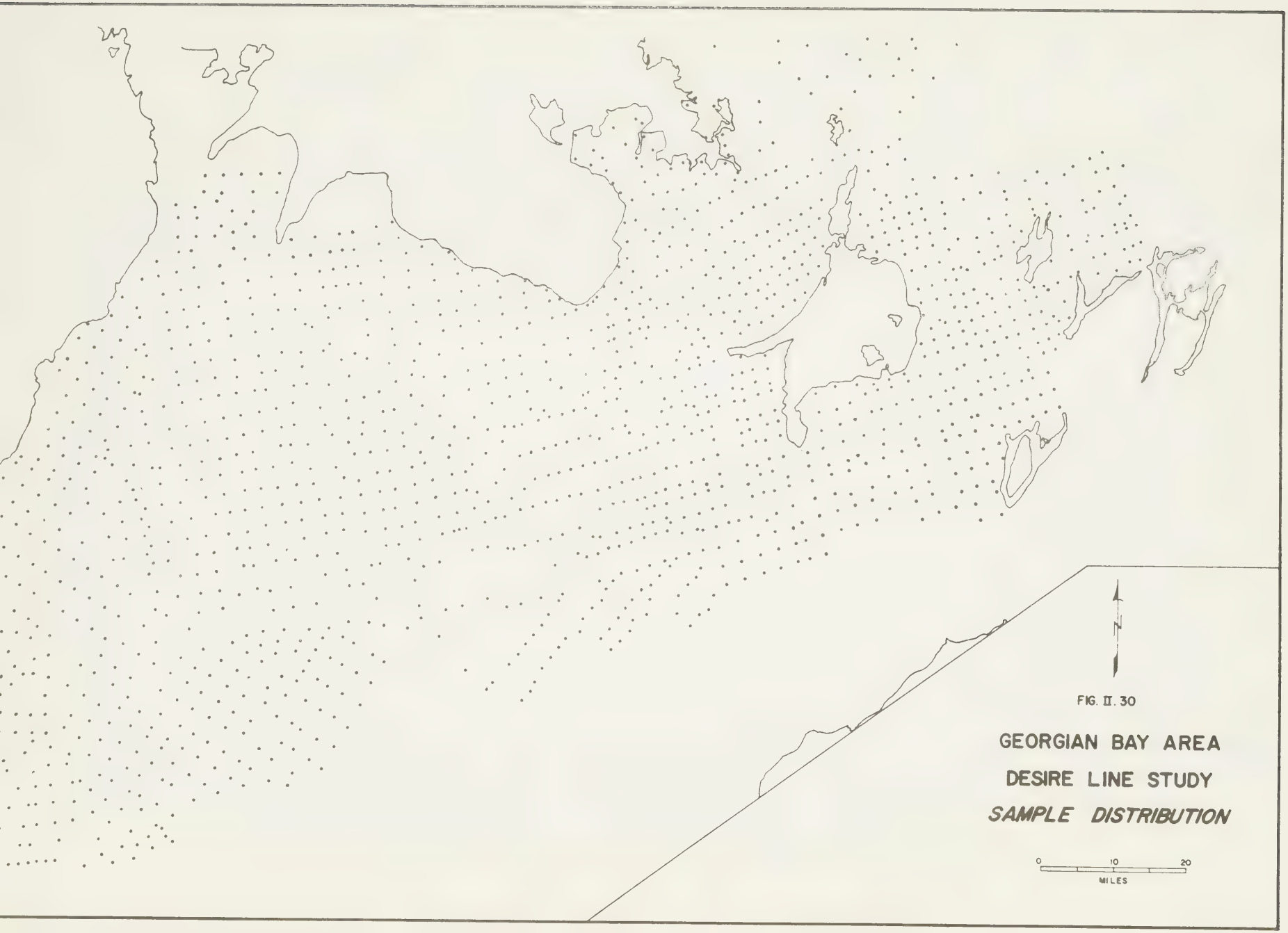


FIG. II. 30

GEORGIAN BAY AREA

DESIRE LINE STUDY

SAMPLE DISTRIBUTION

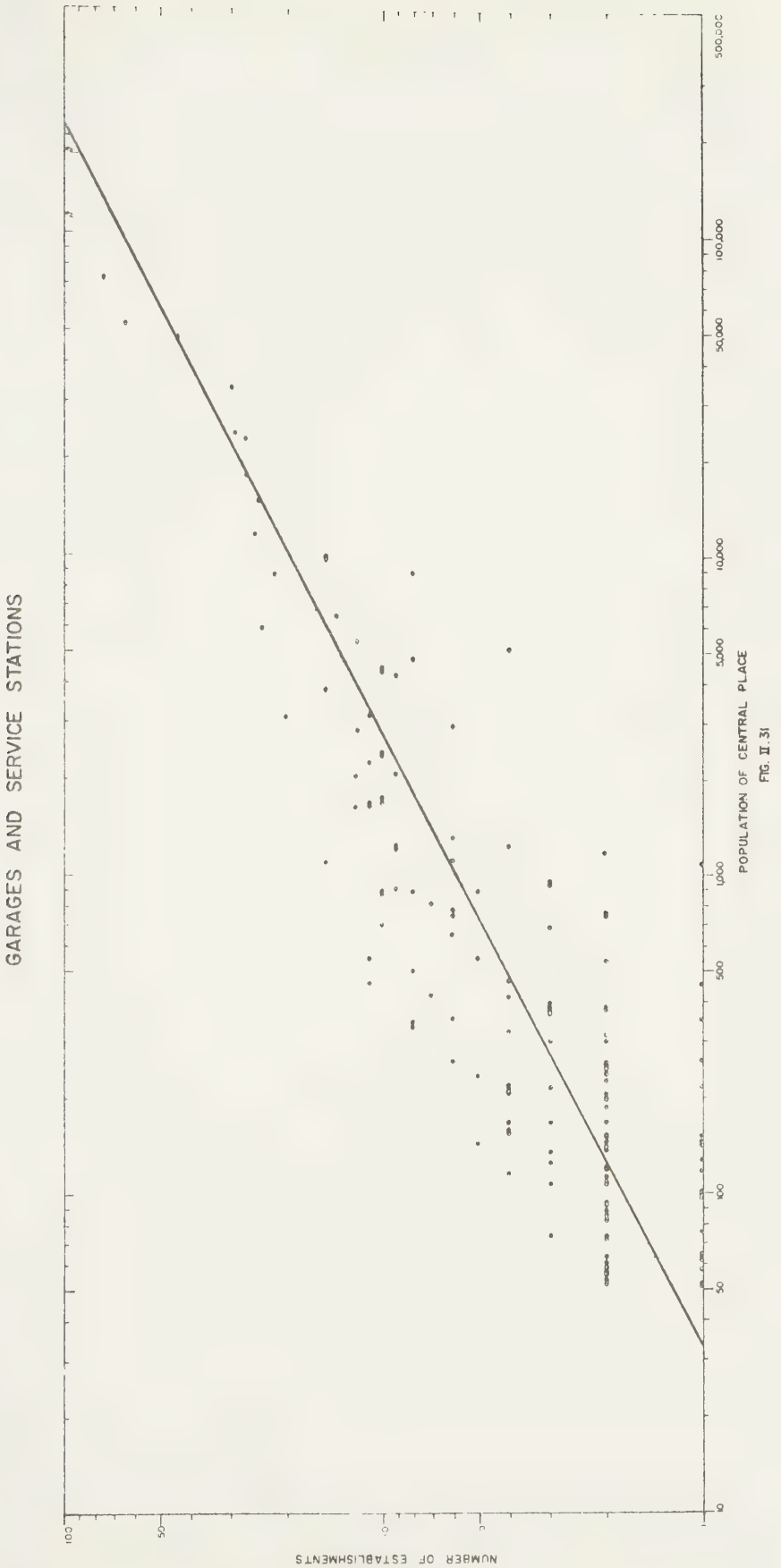

GARAGES AND SERVICE STATIONS
NUMBER OF ESTABLISHMENTS
100
50
0
1
10
50
100
500
1,000
5,000
10,000
50,000
100,000
500,000
POPULATION OF CENTRAL PLACE

FIG. II.31

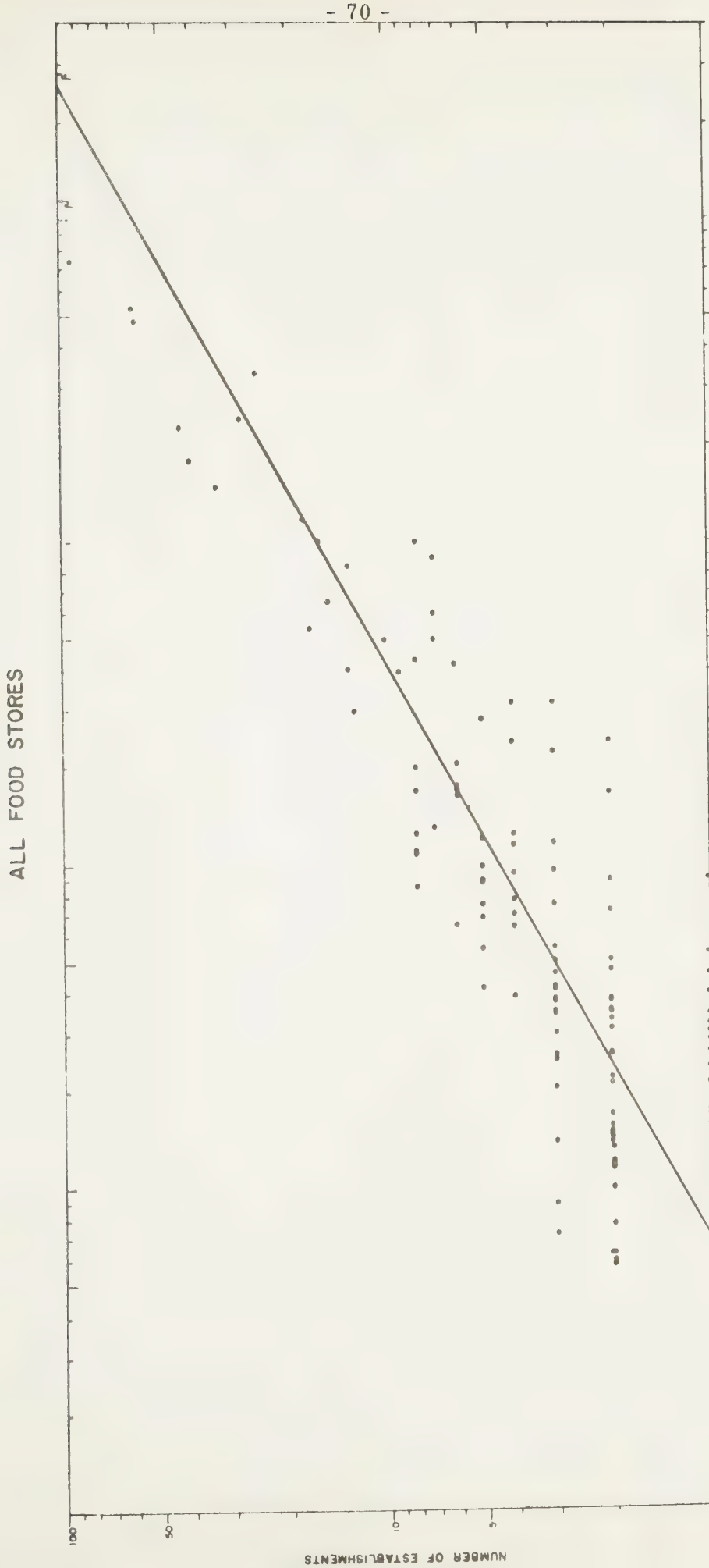
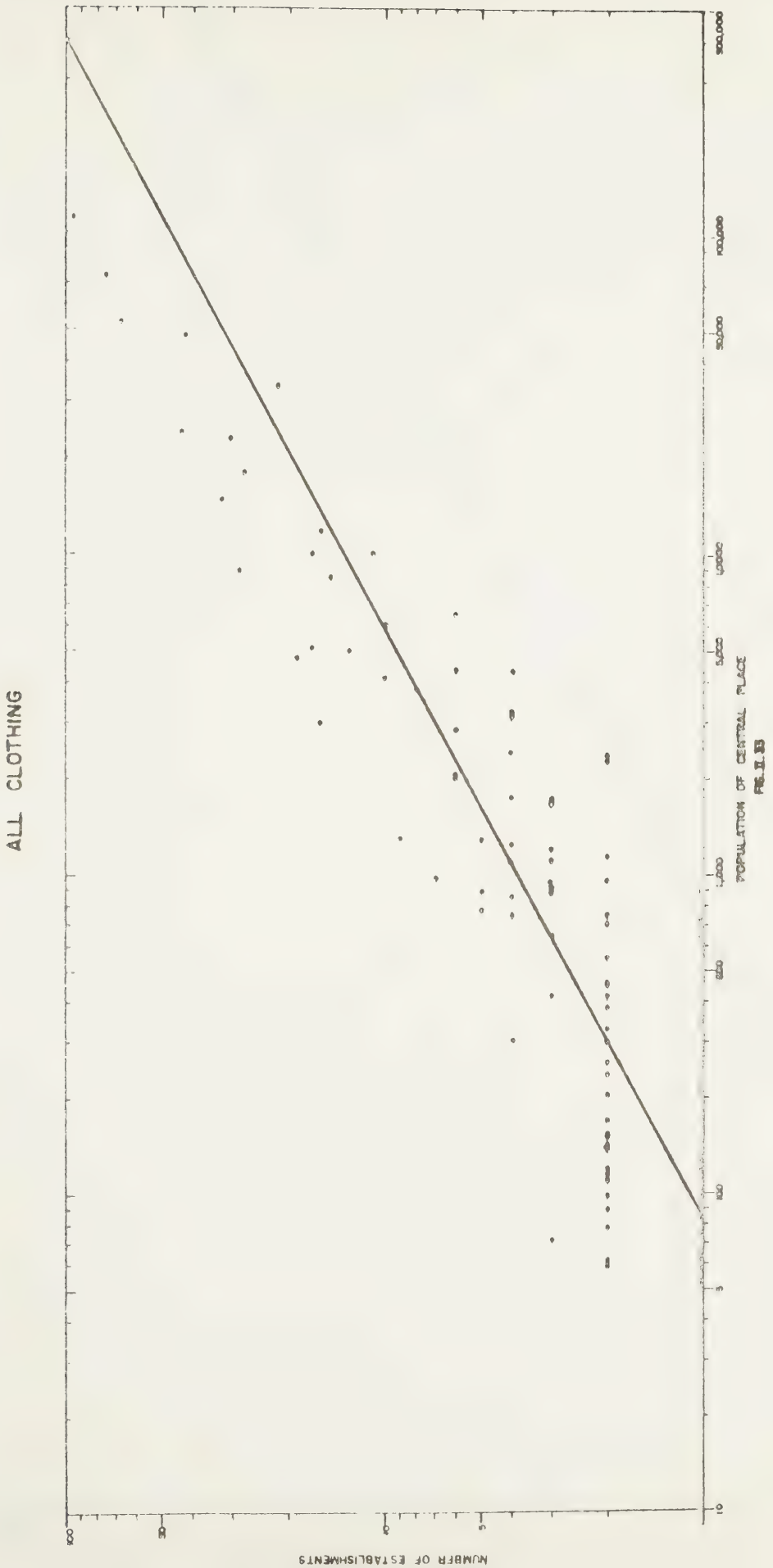

ALL FOOD STORES
NUMBER OF ESTABLISHMENTS
100
50
10
5
1
0
50
100
500
1,000
5,000
10,000
50,000
100,000
POPULATION OF CENTRAL PLACE

FIG II 32


ALL CLOTHING
NUMBER OF ESTABLISHMENTS
POPULATION OF CENTRAL PLACE
FIG. II.13

BANKS

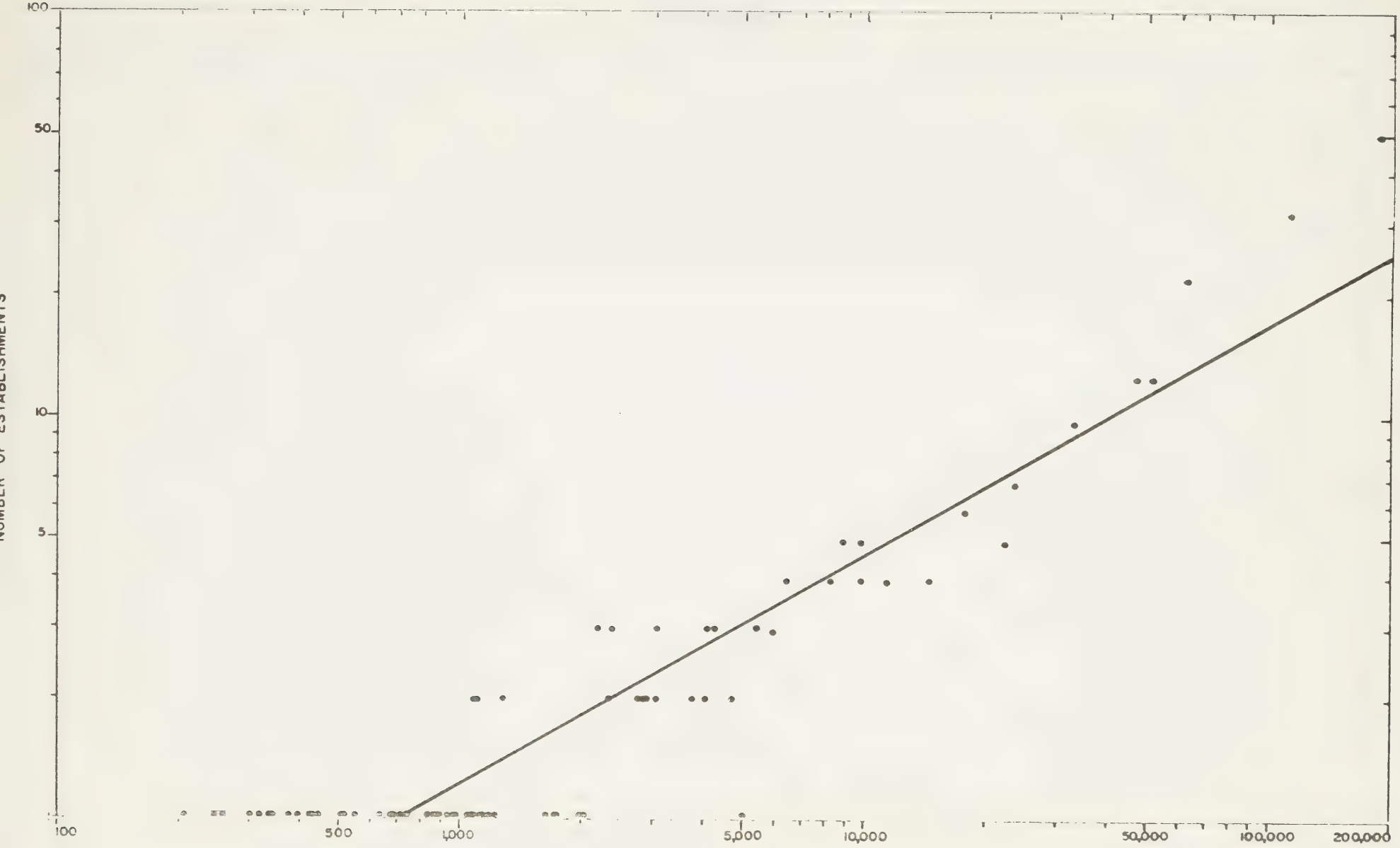


FIG. II. 34

LAWYERS

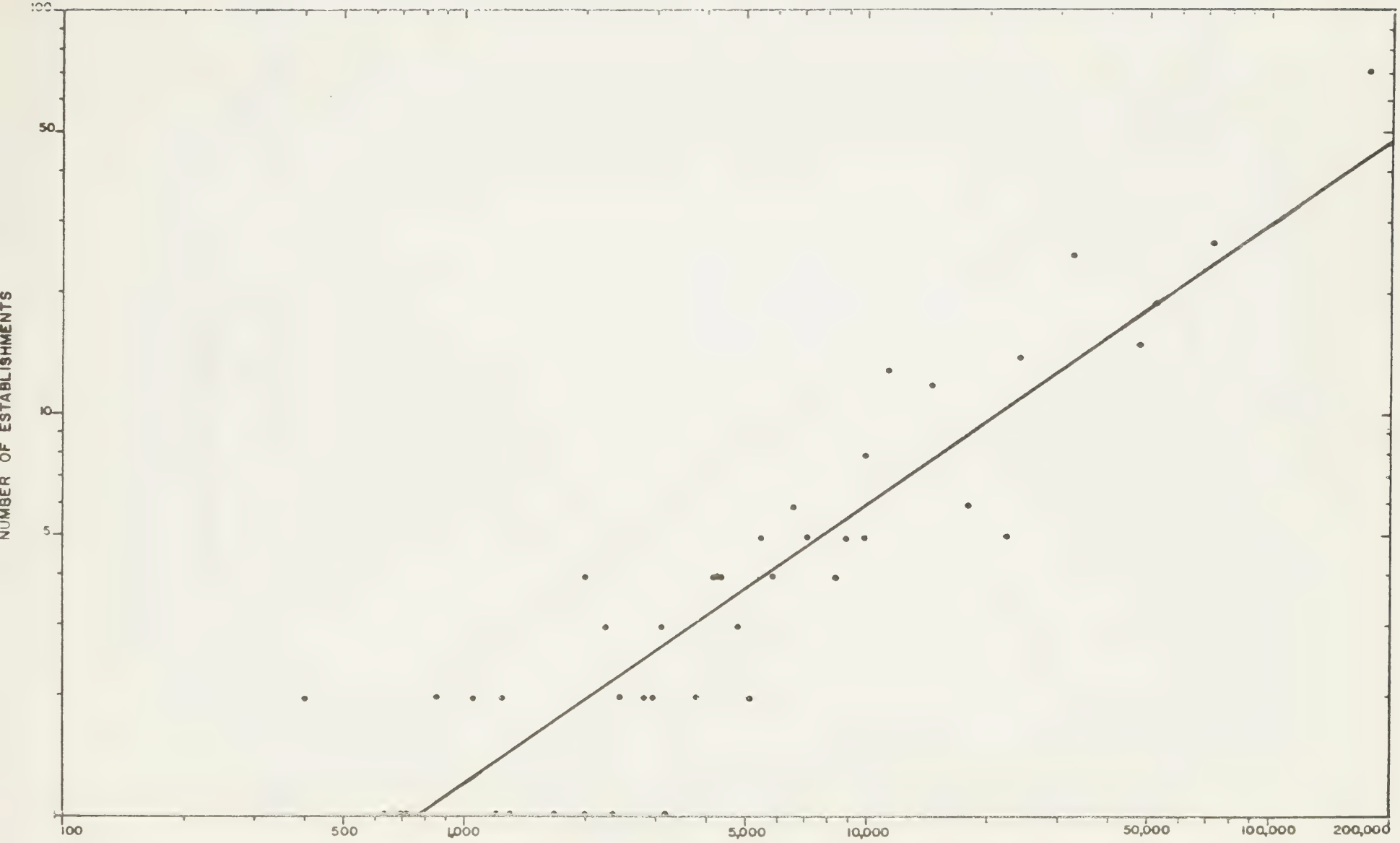


FIG. II. 35

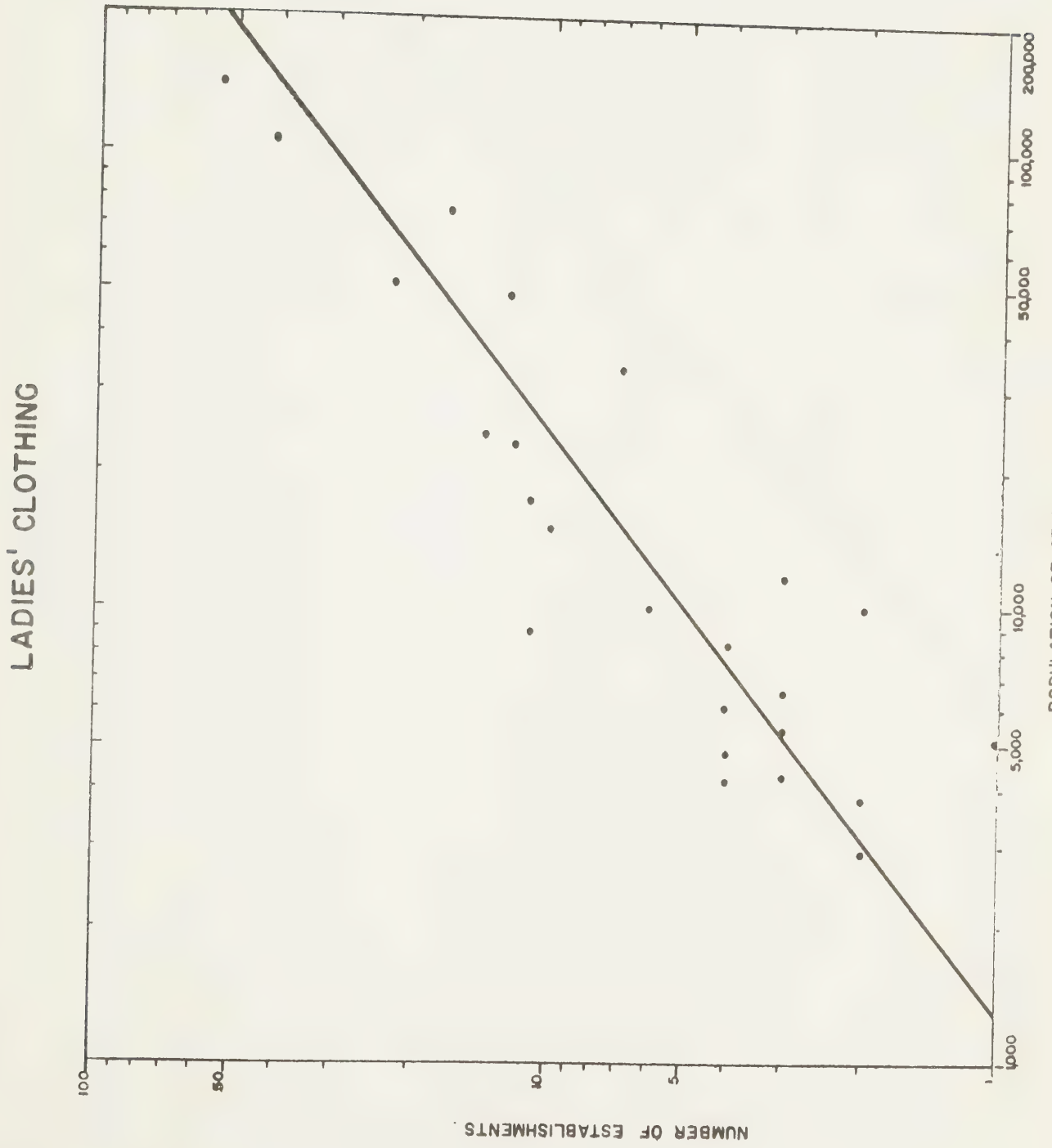

LADIES' CLOTHING
NUMBER OF ESTABLISHMENTS
100
50
10
5
1
1000
5,000
10,000
50,000
100,000
200,000
POPULATION OF CENTRAL PLACE

FIG. II. 36

DENTISTS

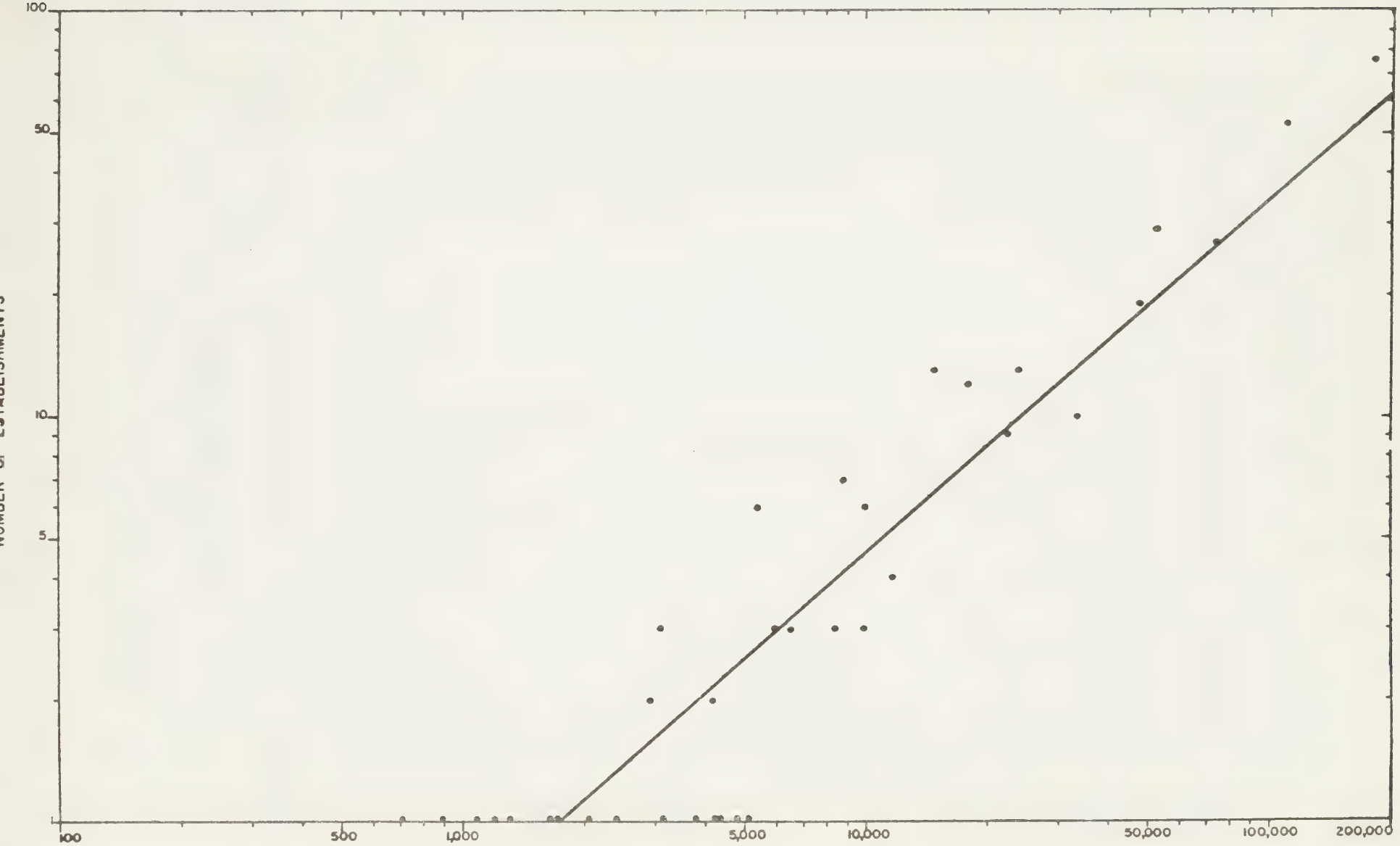


FIG. II. 37

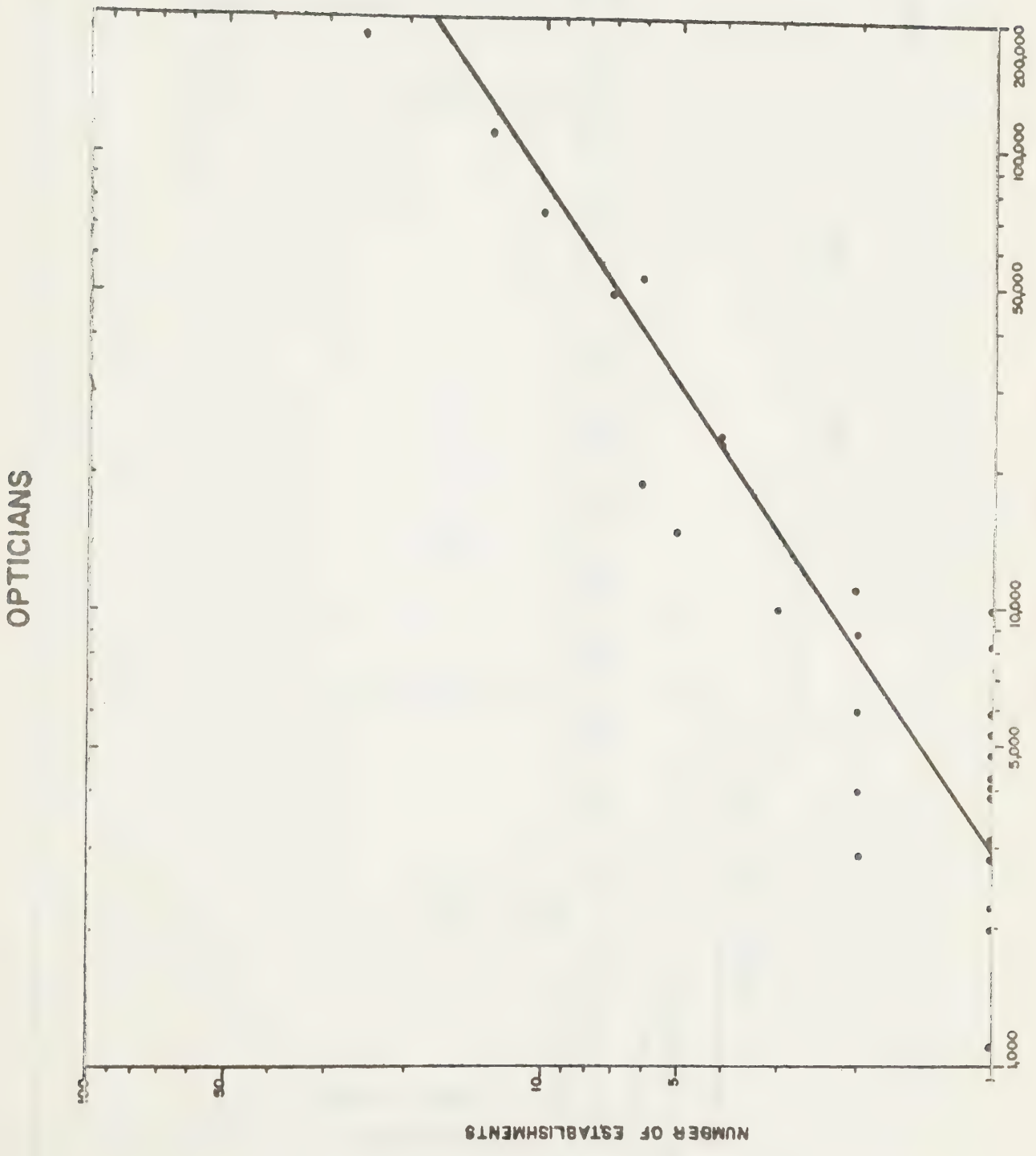
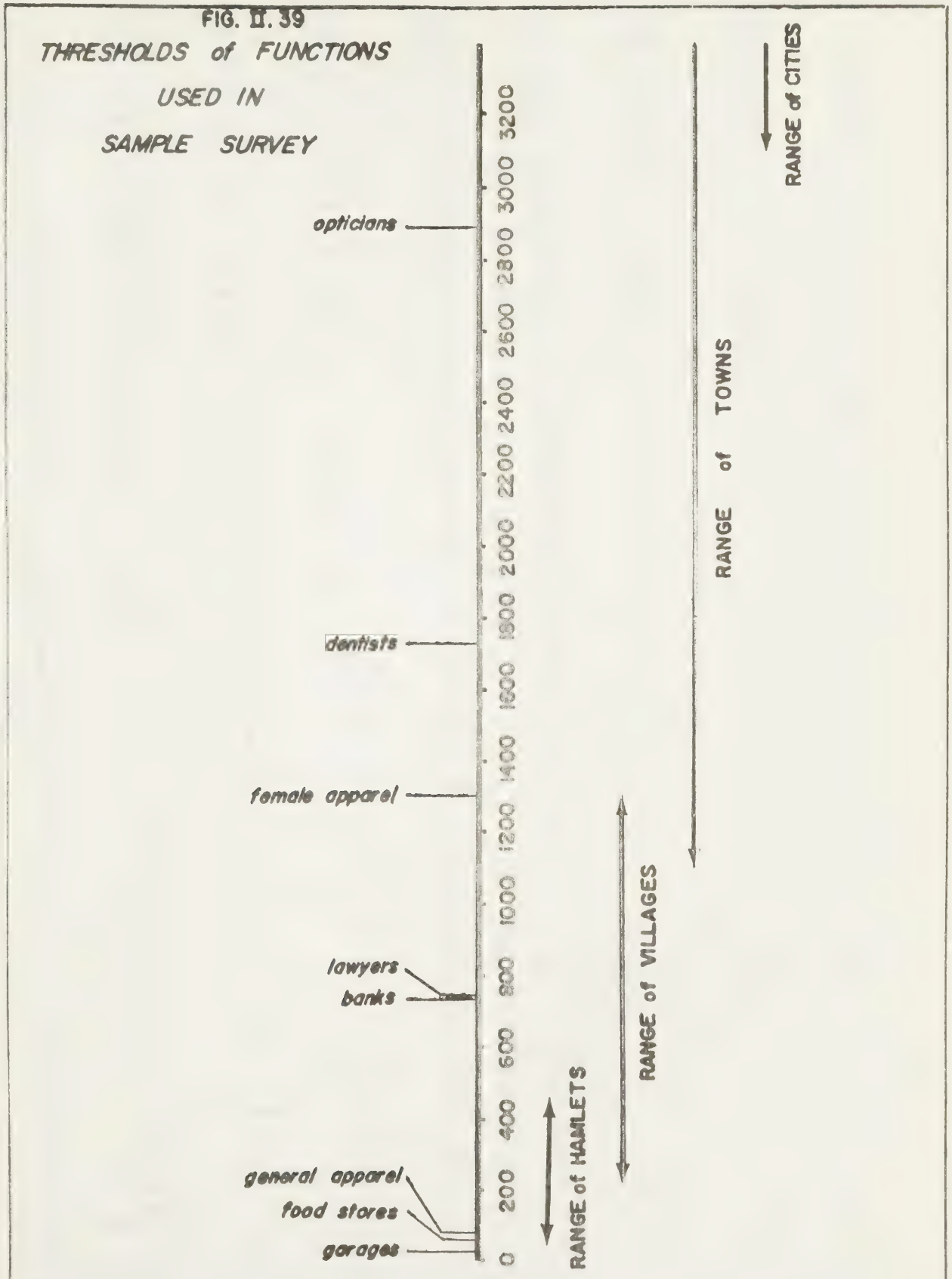

OPTICIANS
NUMBER OF ESTABLISHMENTS
100
50
10
5
1
1,000
5,000
10,000
50,000
100,000
200,000
POPULATION OF CENTRAL PLACE

FIG. II. 38

FIG. II. 39

THRESHOLDS of FUNCTIONS USED IN SAMPLE SURVEY



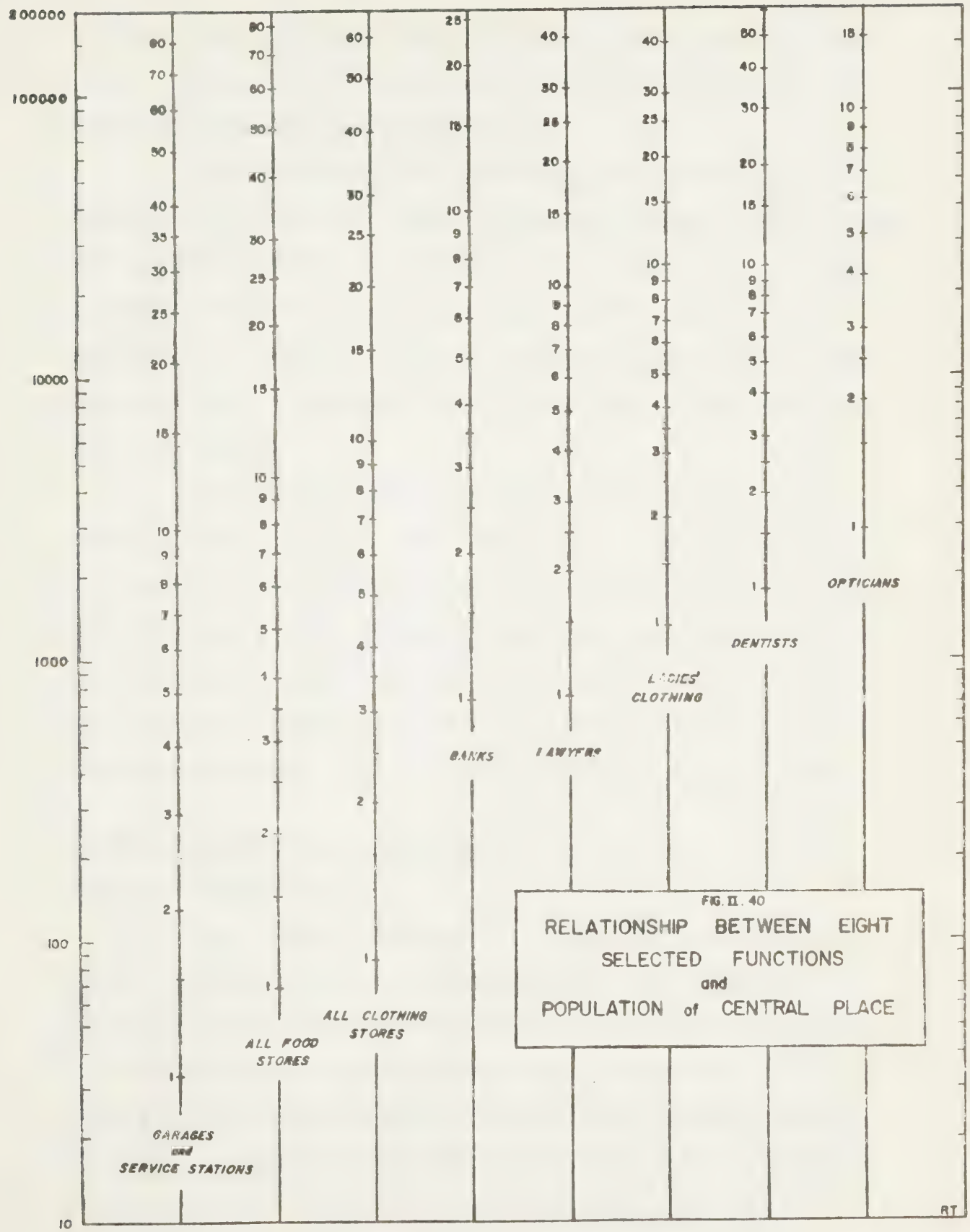


FIG. II. 40

RELATIONSHIP BETWEEN EIGHT SELECTED FUNCTIONS and POPULATION of CENTRAL PLACE

are found in most middle sized towns, while opticians are only found in the largest towns. In fact, the optician category could really be described as primarily only entering the urban hierarchy at the city level.

A nomogram (Figure II.40), summarizing the relationships expressed in Figures II.31 to II.38 has been prepared to illustrate the sequential entering of these eight functions into the functional structures of urban centres. From this nomogram it can be determined that a central place containing 3000 people will typically have 1 optician, 1 (sometimes 2) dentists, 1 (sometimes 2) ladies clothing stores, 2 lawyers, 2 banks, 6 (sometimes 7) general clothing stores, 7 (sometimes 8) food stores, and 10 garages.

The retail questionnaire was therefore designed to demarcate the hinterlands of hamlets, villages, towns, and cities, for no retail function typical of any higher order central place was incorporated into the questionnaire. This is because functional proliferation becomes less and less a characteristic of higher order central places (Table II.10). On the other hand, wholesale activities are more characteristic of higher order central places (Table II.10), and so therefore wholesale activities can be used to define the hinterlands of the larger centres.

The Retail Delimitation of the Southern Boundary of the Georgian Bay Region.

From the sample questionnaires, a series of eight maps have been constructed, one for each of the questions on the questionnaire. Desire lines, or straight lines drawn from the homestead of the person interviewed to the central place that he (in most cases, she) commonly visits for that particular service, present a map-tabulation of the spatially distributed data. Therefore, the length of the desire lines radiating from a particular central place define the hinterland of the central place.

The desire line maps (Figures II.41 - II.48) indicate, as would be expected, small hinterlands for the low order functions, and large hinterlands for the highest order functions. It is to be noted that Toronto, as the overwhelmingly dominant metropolis in Ontario, and to a lesser degree London, as a sub-provincial centre, have a large influence for the highest order central functions. This is most possibly because they offer a greater variety of services within a functional type, as well as within function specialties (such as orthodontists). The broken lines on the female apparel map and the general clothing (or work clothes) map indicate quite a large amount of mail order catalogue purchasing centred on Toronto and, to a lesser degree, London.

From the desire line maps, it can also be seen that the area along the coastline and immediately adjacent to the Georgian Bay is within the nodal region of the following towns and cities: Owen Sound, Meaford, Collingwood, Midland, Barrie, and Orillia. These latter two are particularly important for they provide higher order services that are not found in Midland. The southern limits, or lines of equi-competition (sometimes referred to as spatial indifference) between these towns, and those farther to the south and east, for each of the eight functions, are delimited in Figure II.49 .

The mean line of equi-competition for the eight retail activities (Figure II.50) has been constructed by a process of distance averaging. This line is not too different from that obtained by calculating the mean line for those functions that have proven to be town and city level functions (female clothing, dentists, and opticians).

Therefore, it would seem efficient to use towns and cities (which Hodge suggests to be a viable class of central place - see Table II.9), and functions typical of towns and cities, to delimit the boundary of the Georgian Bay region based on retail criteria.

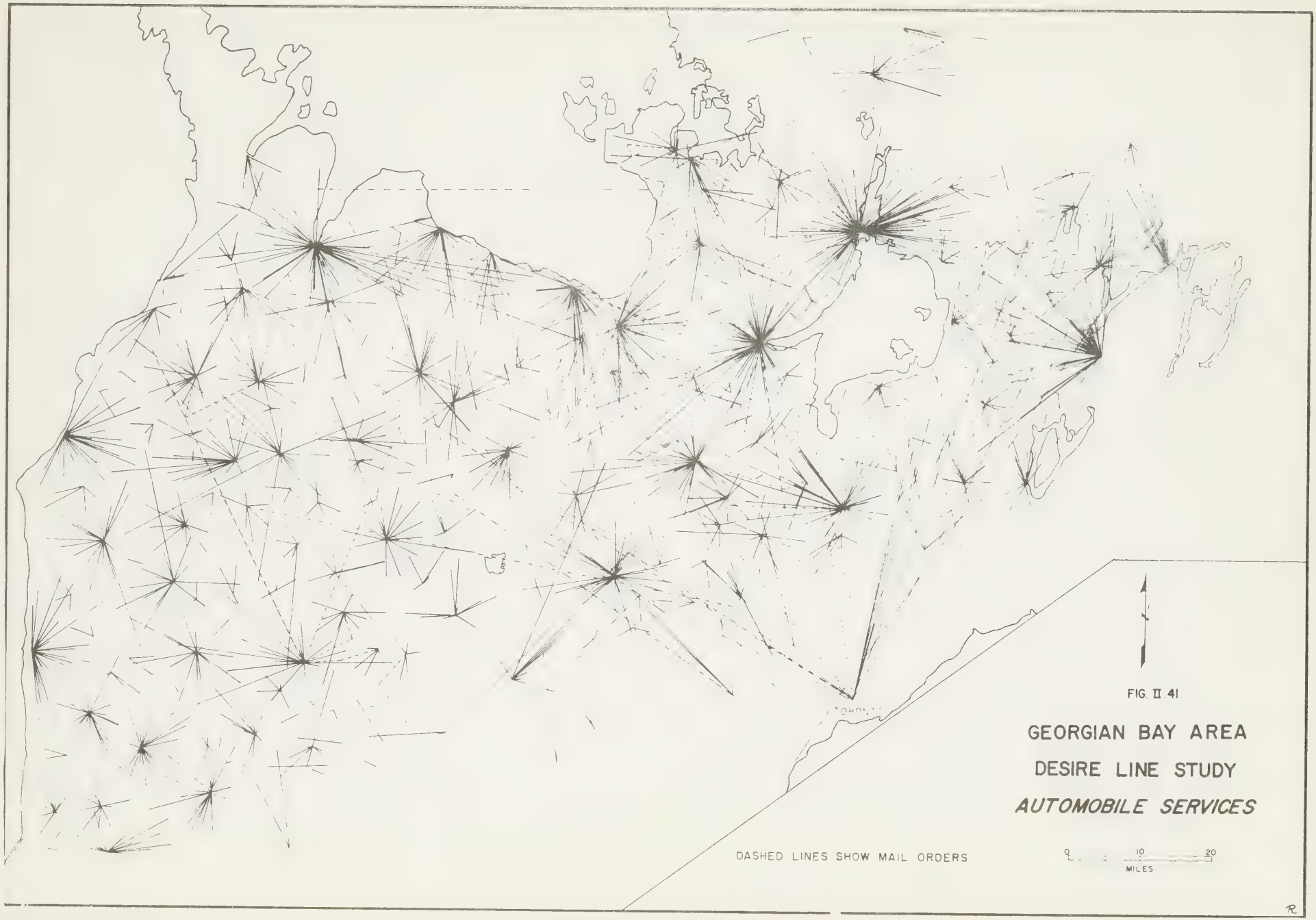


FIG. II.41

GEORGIAN BAY AREA

DESIRE LINE STUDY

AUTOMOBILE SERVICES

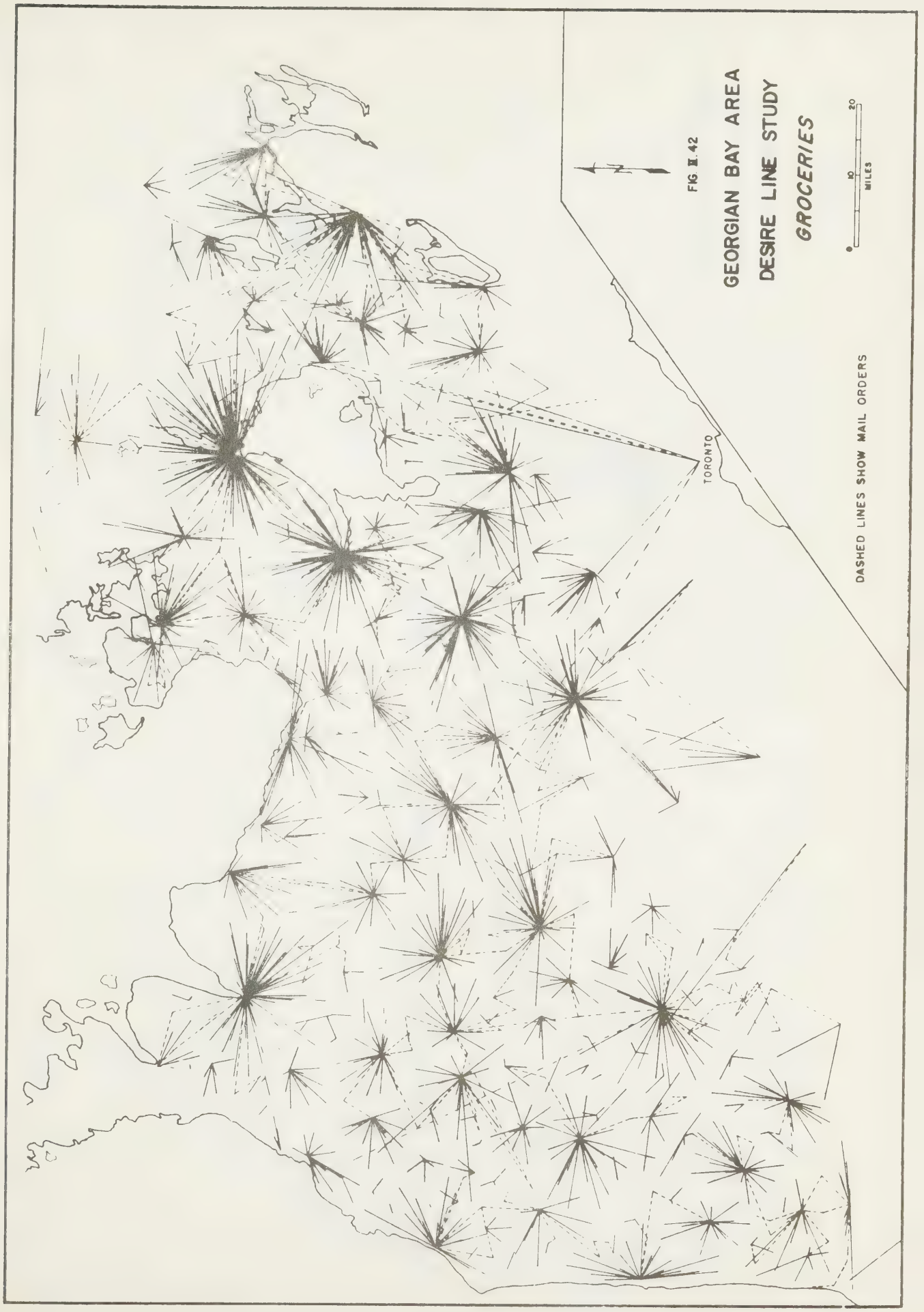


FIG II.42
GEORGIAN BAY AREA
DESIRE LINE STUDY
GROCERIES
0
10
20
MILES
TORONTO
DASHED LINES SHOW MAIL ORDERS

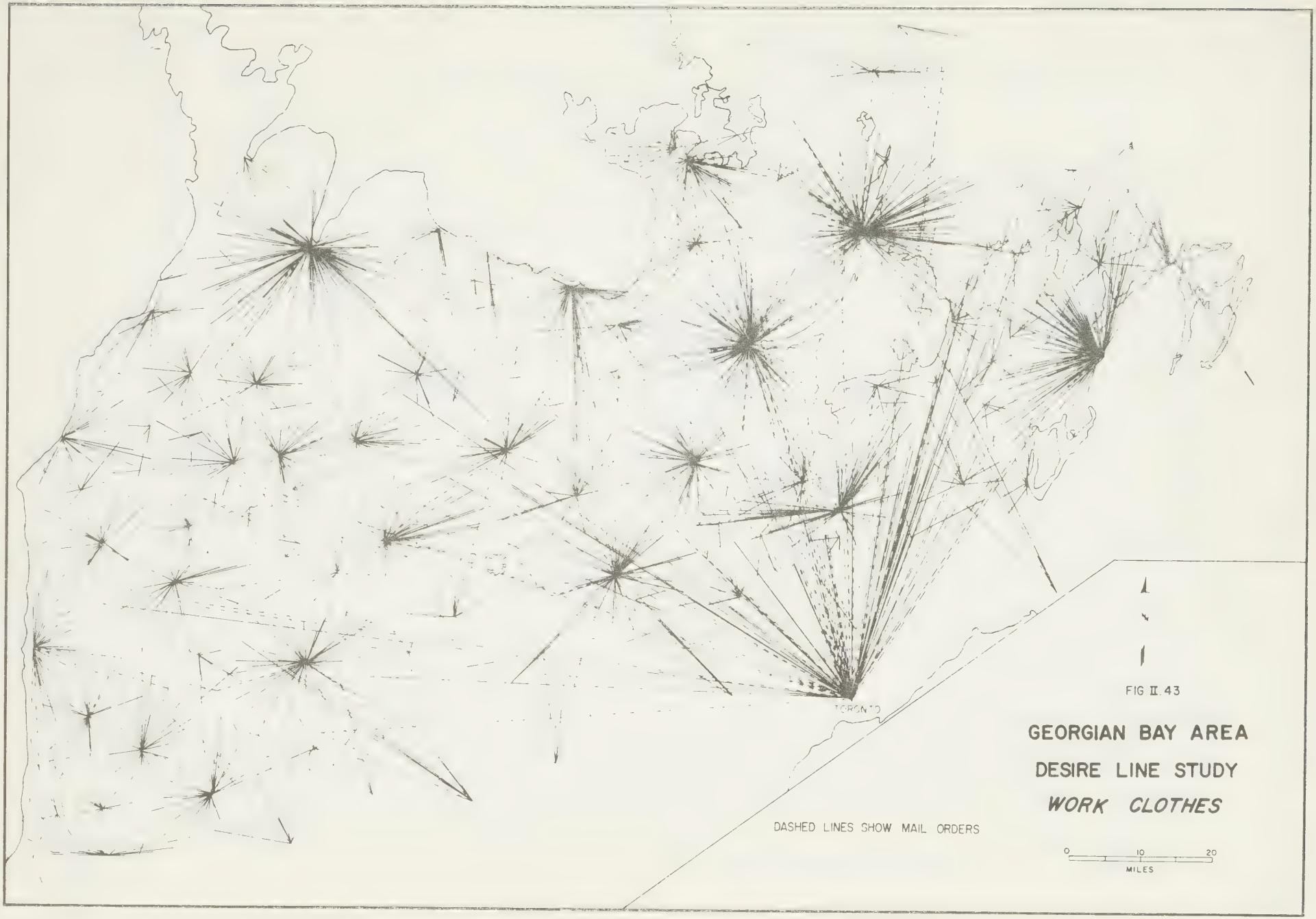
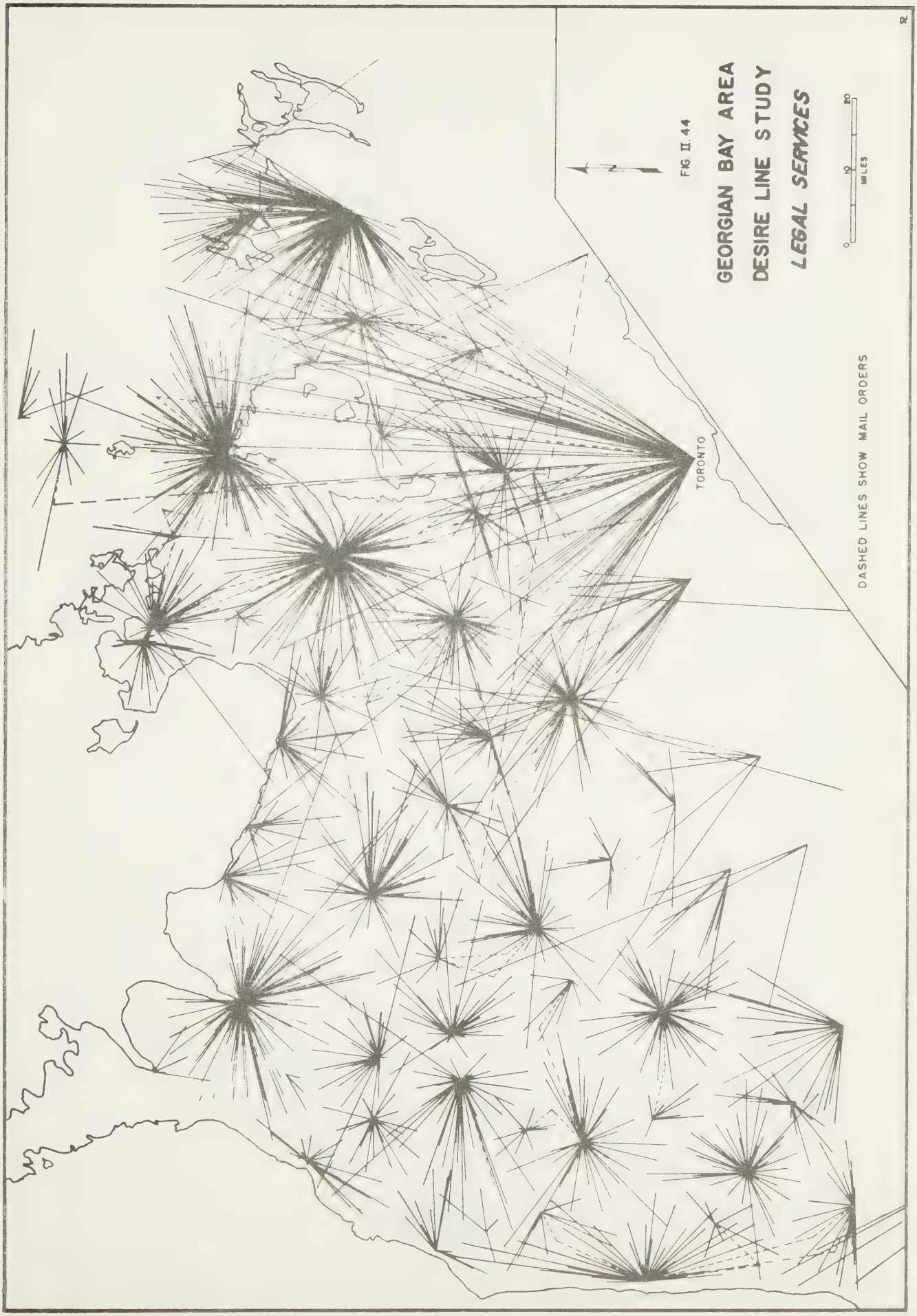


FIG II.43

GEORGIAN BAY AREA

DESIRE LINE STUDY

WORK CLOTHES


GEORGIAN BAY AREA
DESIRE LINE STUDY
LEGAL SERVICES
FIG. II.44
0
10
20
MILES
TORONTO
DASHED LINES SHOW MAIL ORDERS

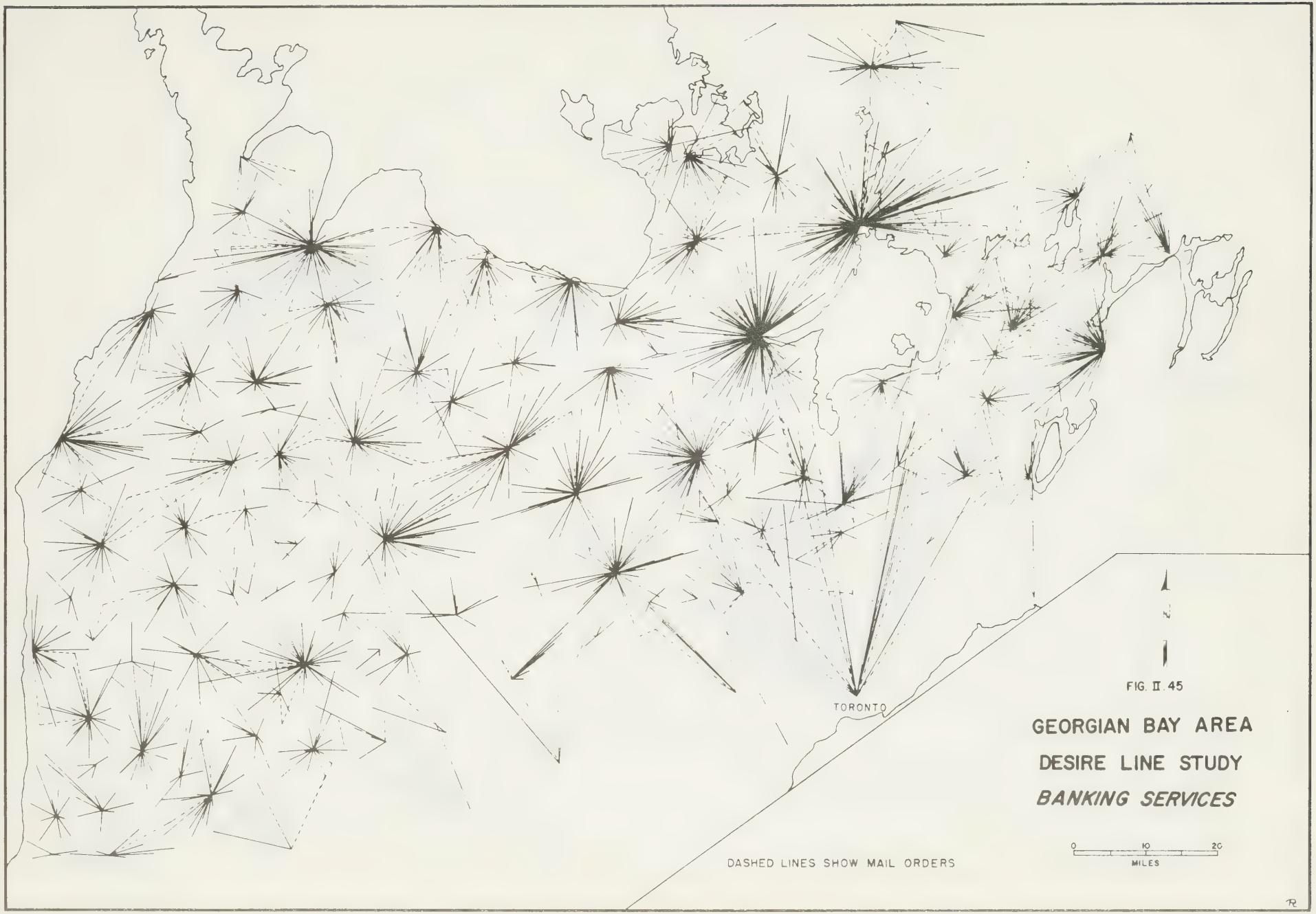


FIG. II.45

GEORGIAN BAY AREA

DESIRE LINE STUDY

BANKING SERVICES

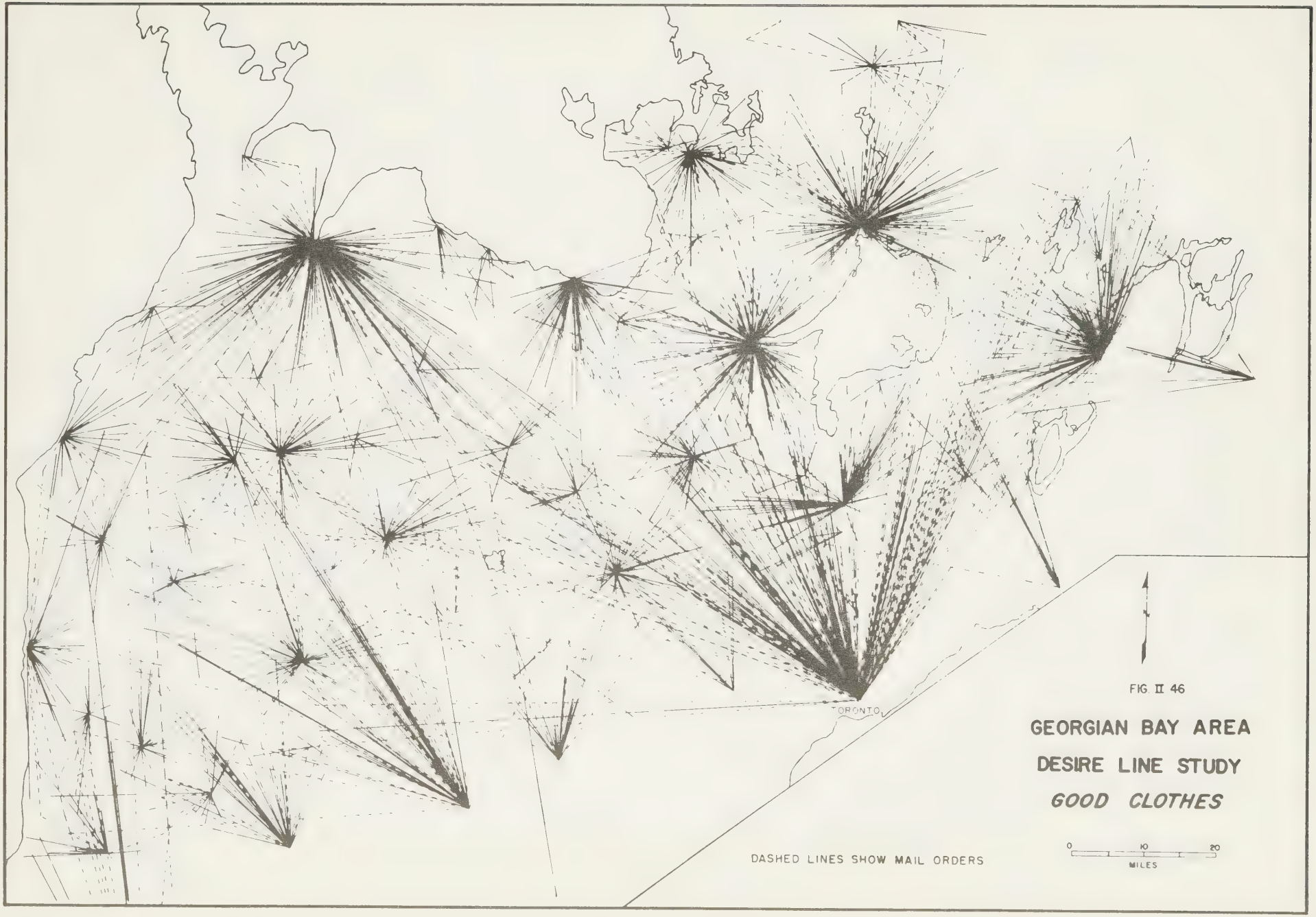


FIG. II 46

GEORGIAN BAY AREA

DESIRE LINE STUDY

GOOD CLOTHES

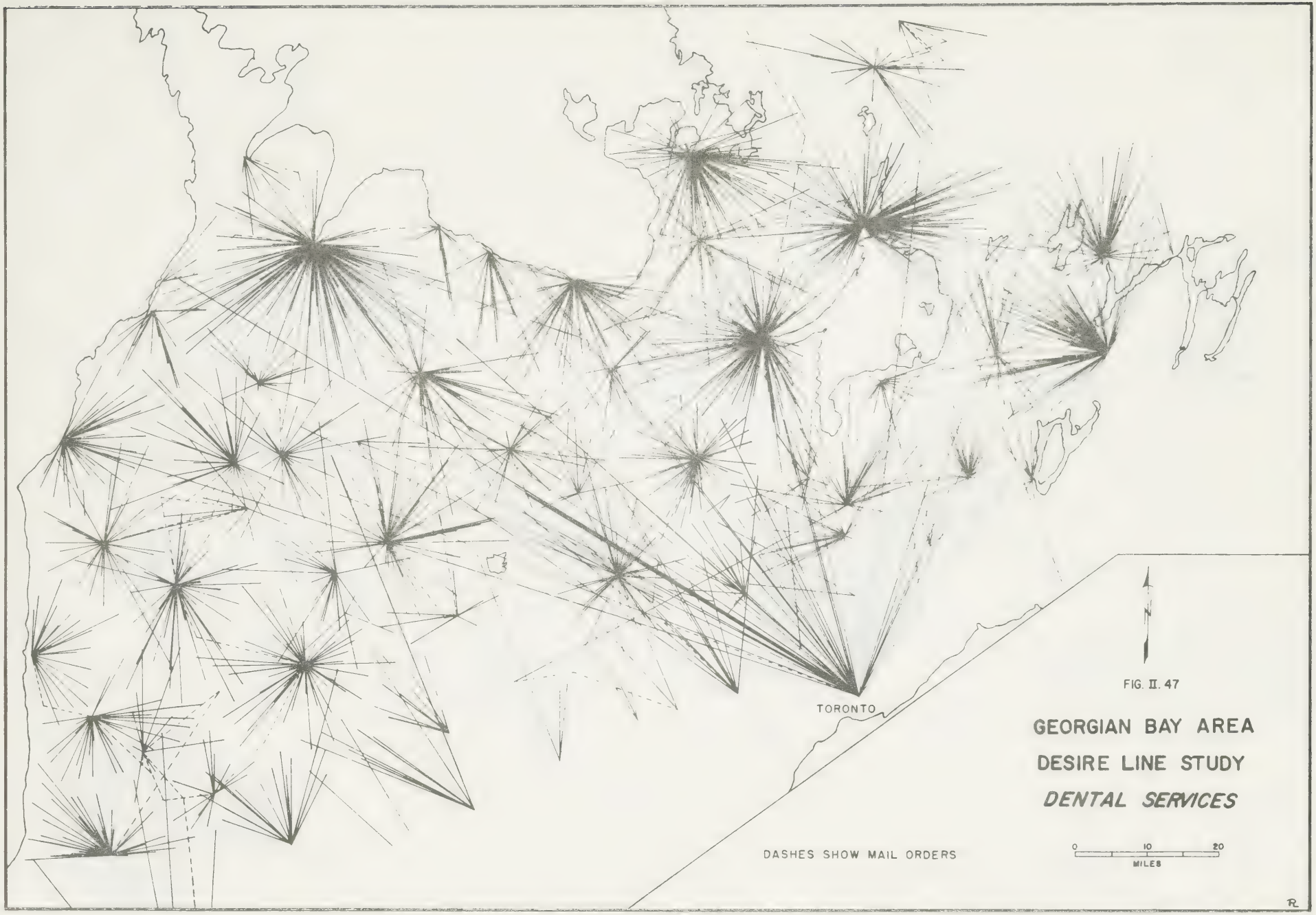


FIG. II. 47

GEORGIAN BAY AREA

DESIRE LINE STUDY

DENTAL SERVICES

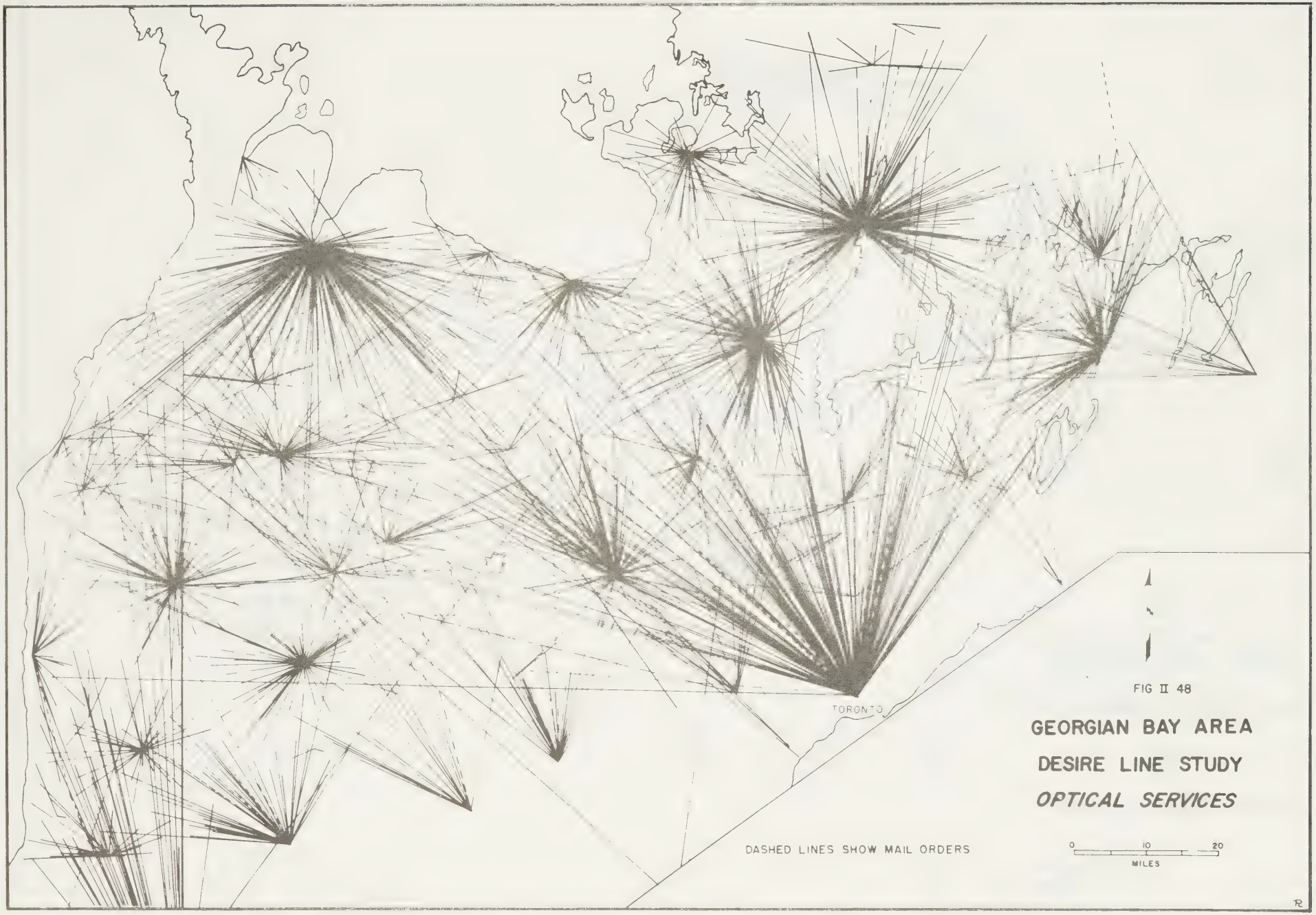


FIG II 48

GEORGIAN BAY AREA

DESIRE LINE STUDY

OPTICAL SERVICES

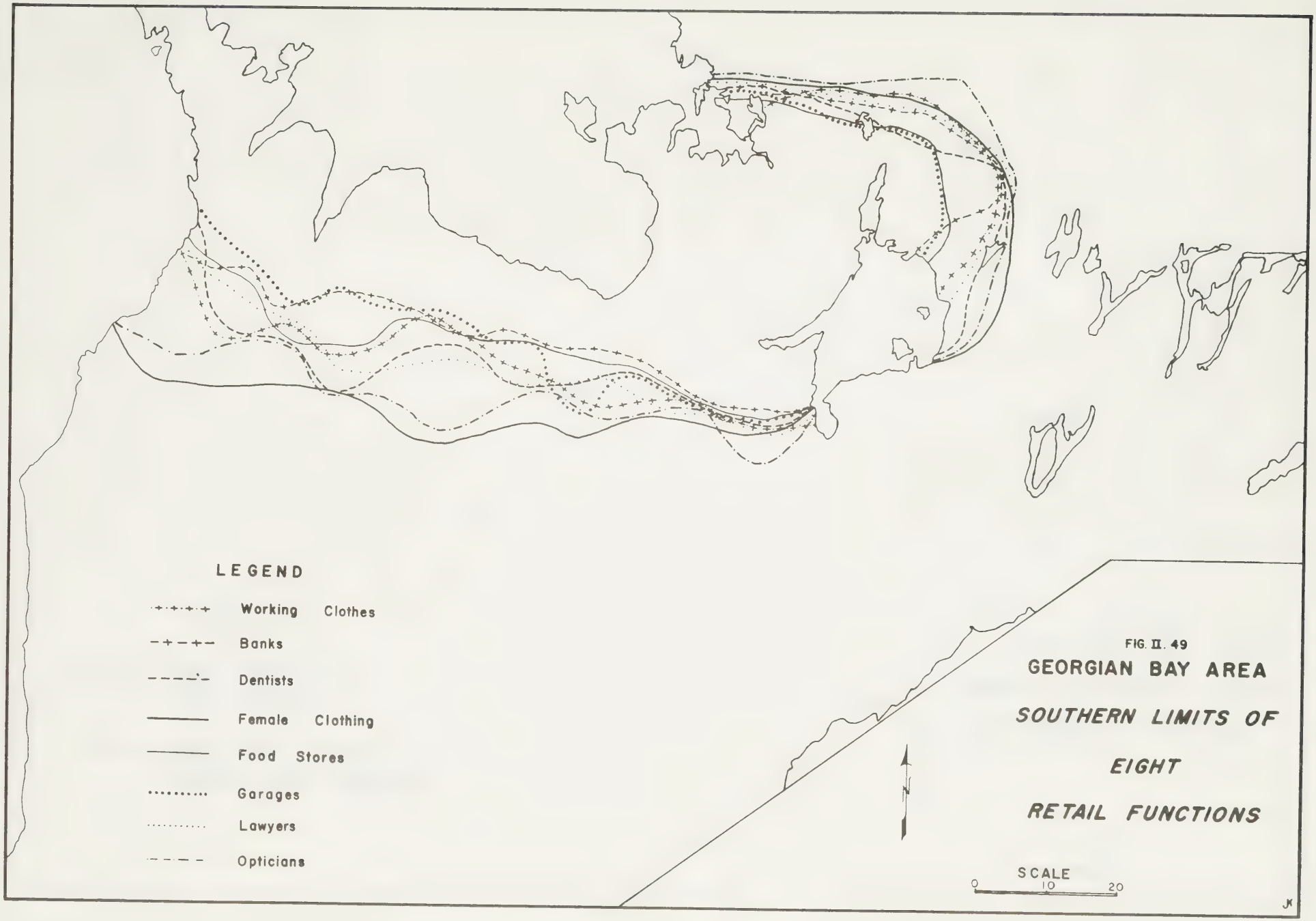


FIG. II. 49

GEORGIAN BAY AREA

SOUTHERN LIMITS OF EIGHT RETAIL FUNCTIONS

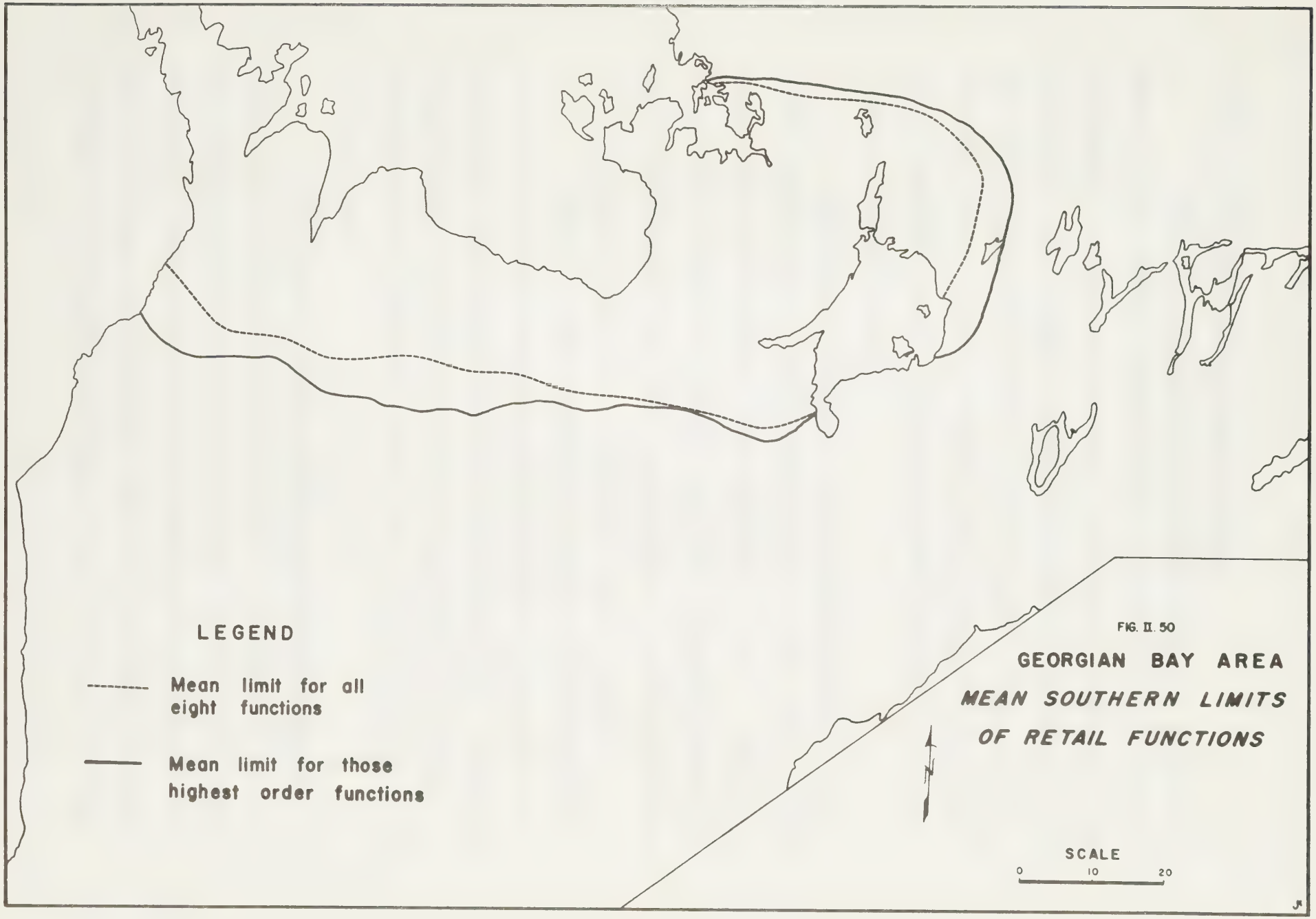


FIG. II. 50

GEORGIAN BAY AREA

MEAN SOUTHERN LIMITS OF RETAIL FUNCTIONS

A Wholesale Delimitation of the Georgian Bay Region

Wholesale Activities and the Central Place Hierarchy. The wholesale sector of tertiary activity is an aspect that has received singularly little attention in the geographic, or any other, literature. The Borchert and Adams study of the Upper Midwest, and the Hodge study in southern Saskatchewan indicate that wholesale establishments are only found in the higher order centres. This seems to be so in the Georgian Bay study area, though the numbers of wholesale establishments found in the middle-order central places differ markedly (see Table II.10, and compare with Tables II.7 and II.8).

The difference in numbers of wholesale establishments found in the middle-order central places might be attributed to the proximity of Toronto. Almost the entire area of the intensively surveyed part of the study area is within one hundred to two hundred miles of Toronto, so many large wholesaling companies find it more efficient to trade from Toronto than to set up branch warehouses and offices. This would be particularly true for the higher order warehouse activities.

However it is both interesting and important to note that there is a close positive relationship between the number of warehousing companies found in a central place and the population of a central place (Figure II.51). Furthermore, the graph suggests that the threshold central place population for a warehouse establishment is about 2000 people. In other words, warehousing generally begins at the town level.

Field Research Procedures for Determining Wholesale Hinterlands. Warehouse hinterlands were constructed by visiting every central place in the study area and ascertaining from selected retail functions the immediate source of certain characteristic items. As many as 213 central places were visited, ranging from remote country shack-stores to the larger urban centres. All central places from the village level to sub-regional centres were included in the survey, but some

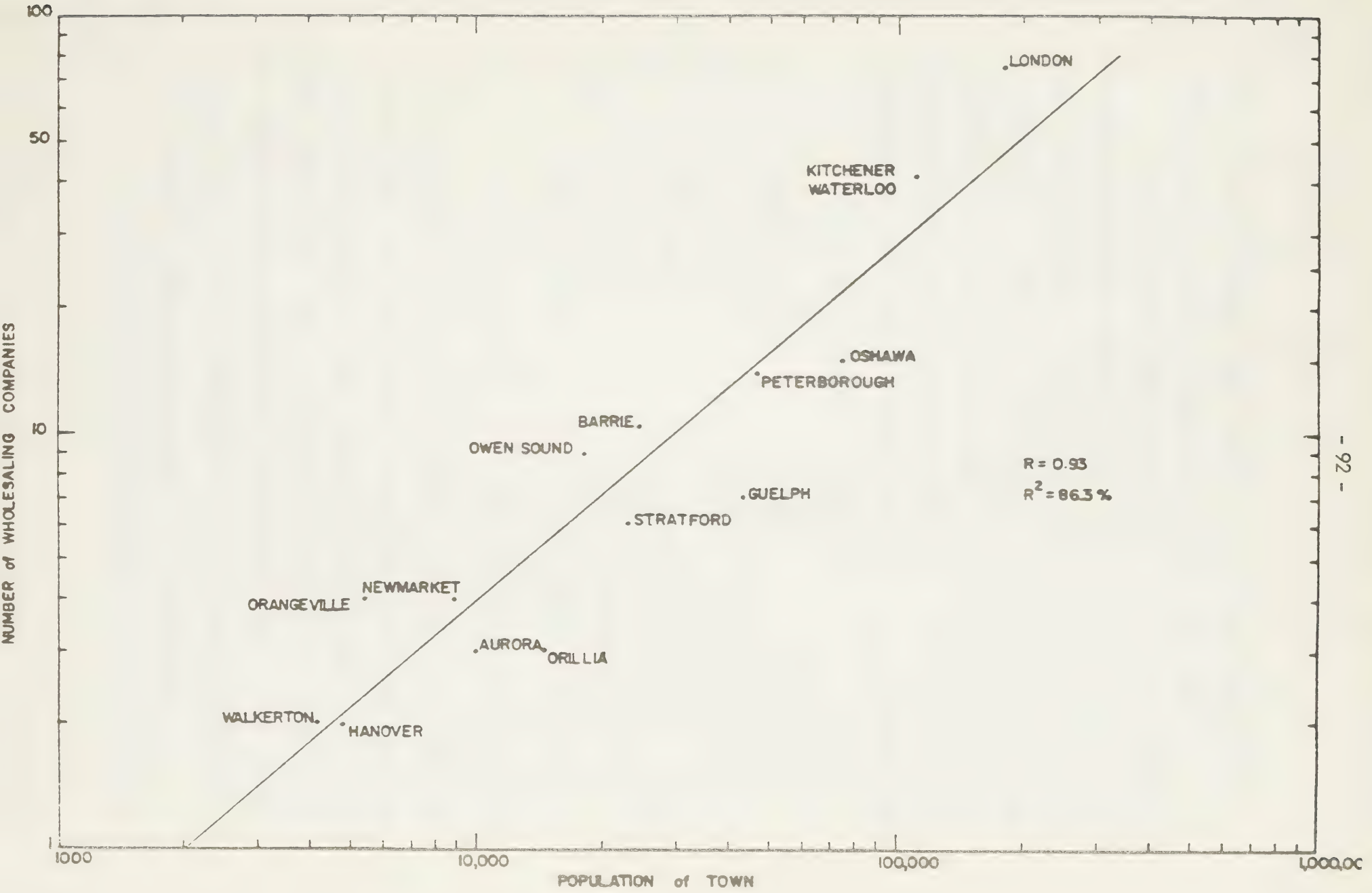

100
50
10
NUMBER of WHOLESALING COMPANIES
LONDON
KITCHENER
WATERLOO
OSHAWA
PETERBOROUGH
BARRIE
OWEN SOUND
GUELPH
STRATFORD
NEWMARKET
ORANGEVILLE
AURORA
ORILLIA
WALKERTON
HANOVER
R = 0.93
R² = 86.3 %
1000
10,000
100,000
1,000,000
POPULATION of TOWN

FIG. II. 51

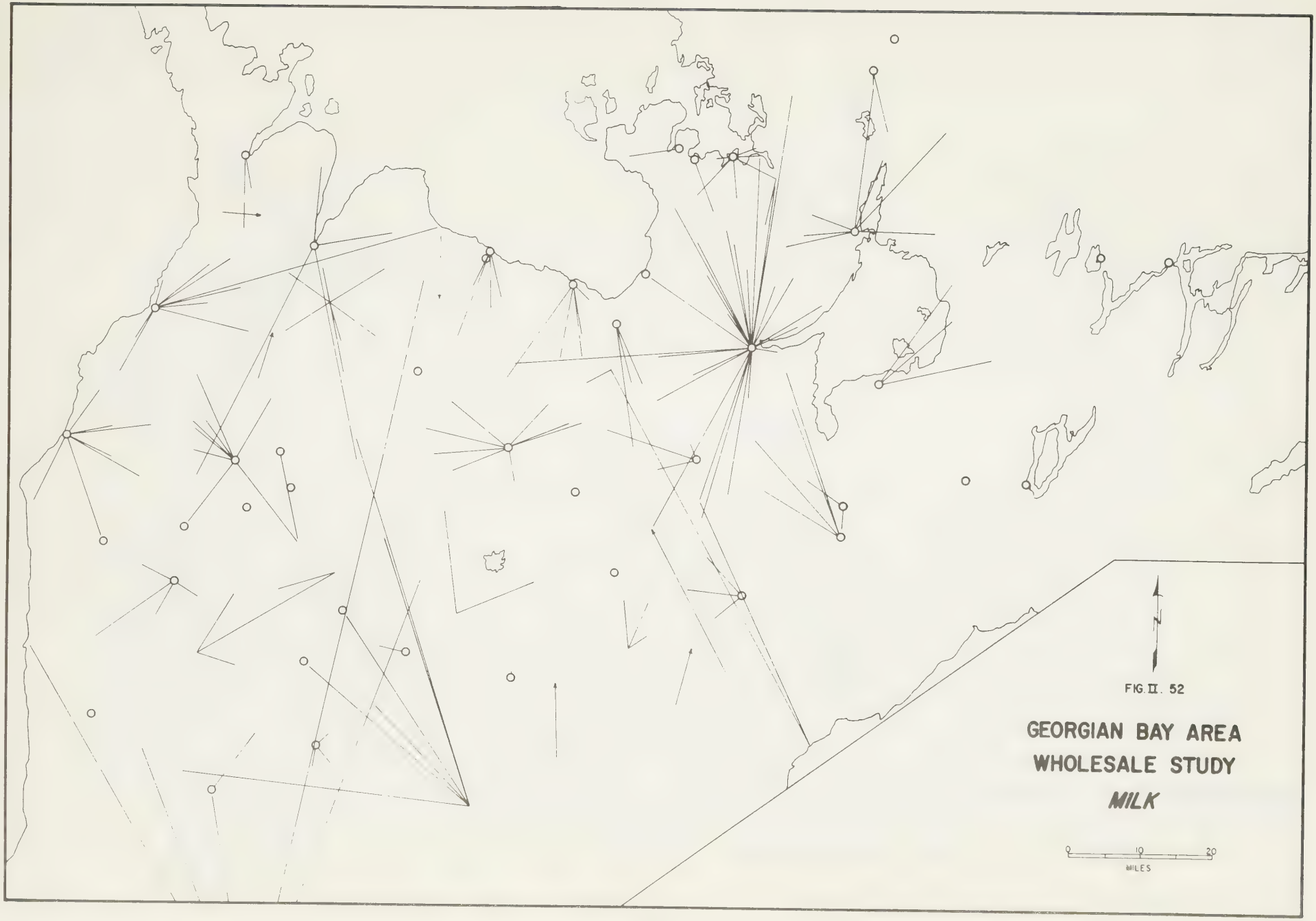
hamlets of less than 50 people might have been missed. Without doubt, all the 178 places mentioned used in the classification procedure were visited.

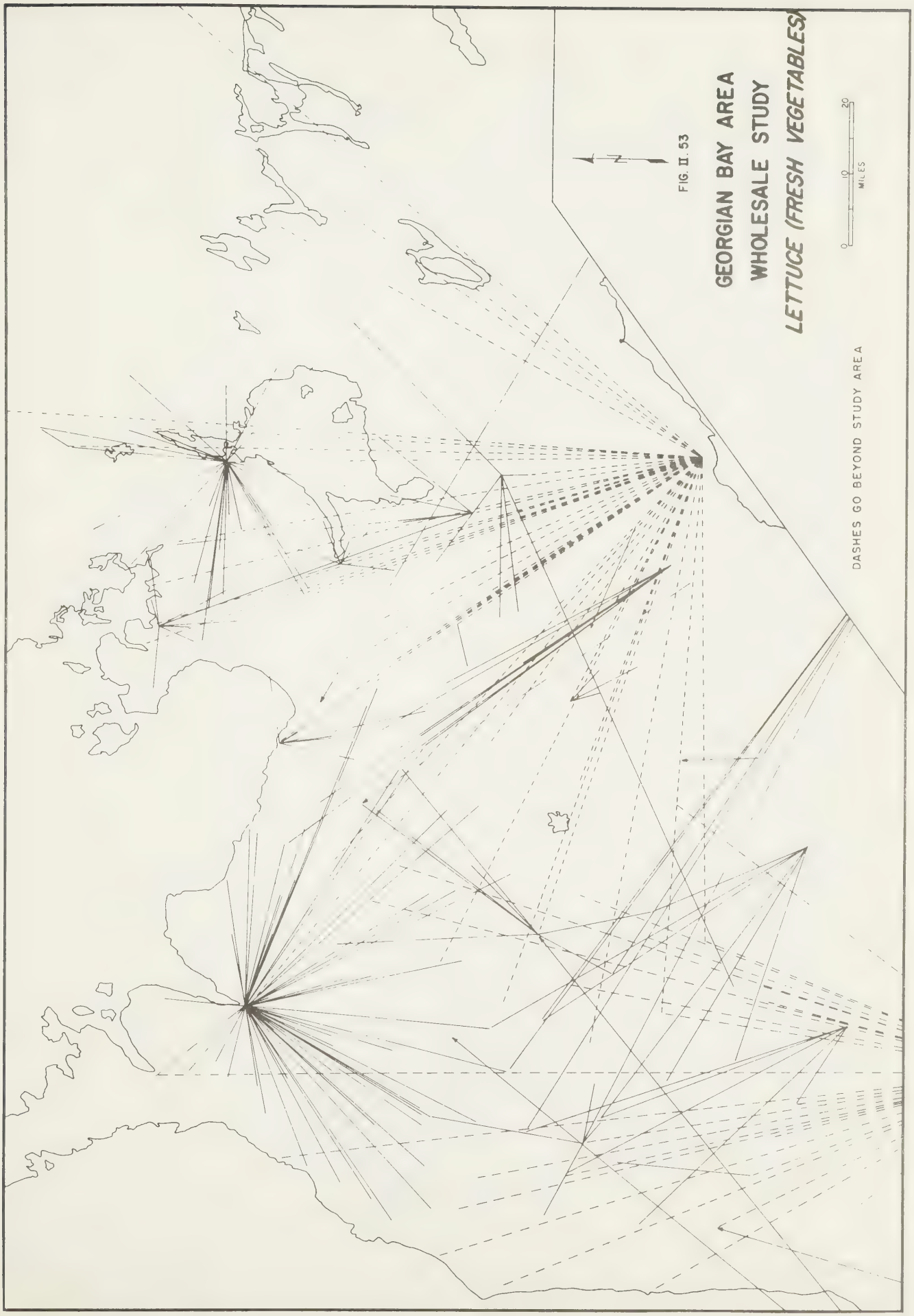
For every centre smaller than 5000 people, the following wholesale functions were interviewed (where appropriate): Gasoline Service Station, Food Store, Drug Store, Hardware Store. Two of each functional type were interviewed in places larger than 5000. This latter refinement produced no greater detail, but proved that stores of the same functional type invariably receive supplies either from the same warehouse, or from the same central place. The questionnaire was standardized by ascertaining the immediate central place source for specified items:

Gasoline Service Stations	:	Tires Gasoline
Food Store	:	Milk Lettuce Dry packaged goods (flour) Meat
Drug Store	:	Cosmetics Aspirin Toothpaste Behind-the-counter drugs
Hardware Store	:	Electric light bulbs and fixtures Brooms and mops Paints Nuts, bolts, nails, screws (small carpenter items)

The data obtained from the wholesale questionnaire can be presented by desire lines. In this case, however, the desire lines must be interpreted differently. Whereas in the retail survey, the straight lines represented one person or family visiting a central place, in the warehouse case the lines represent goods moving from a wholesale centre out to a number of destinations. In other words, the maps (Figures II.52 to II 60) demonstrate how a set of retail functions found in central places are in themselves served by higher order central places.

From examination of the maps the wholesale functions are tentatively


N
FIG. II. 52
GEORGIAN BAY AREA
WHOLESALE STUDY
MILK
0
10
20
MILES


GEORGIAN BAY AREA
WHOLESALE STUDY
LETTUCE (FRESH VEGETABLES)
FIG. II. 53
0
10
20
MILES
DASHES GO BEYOND STUDY AREA

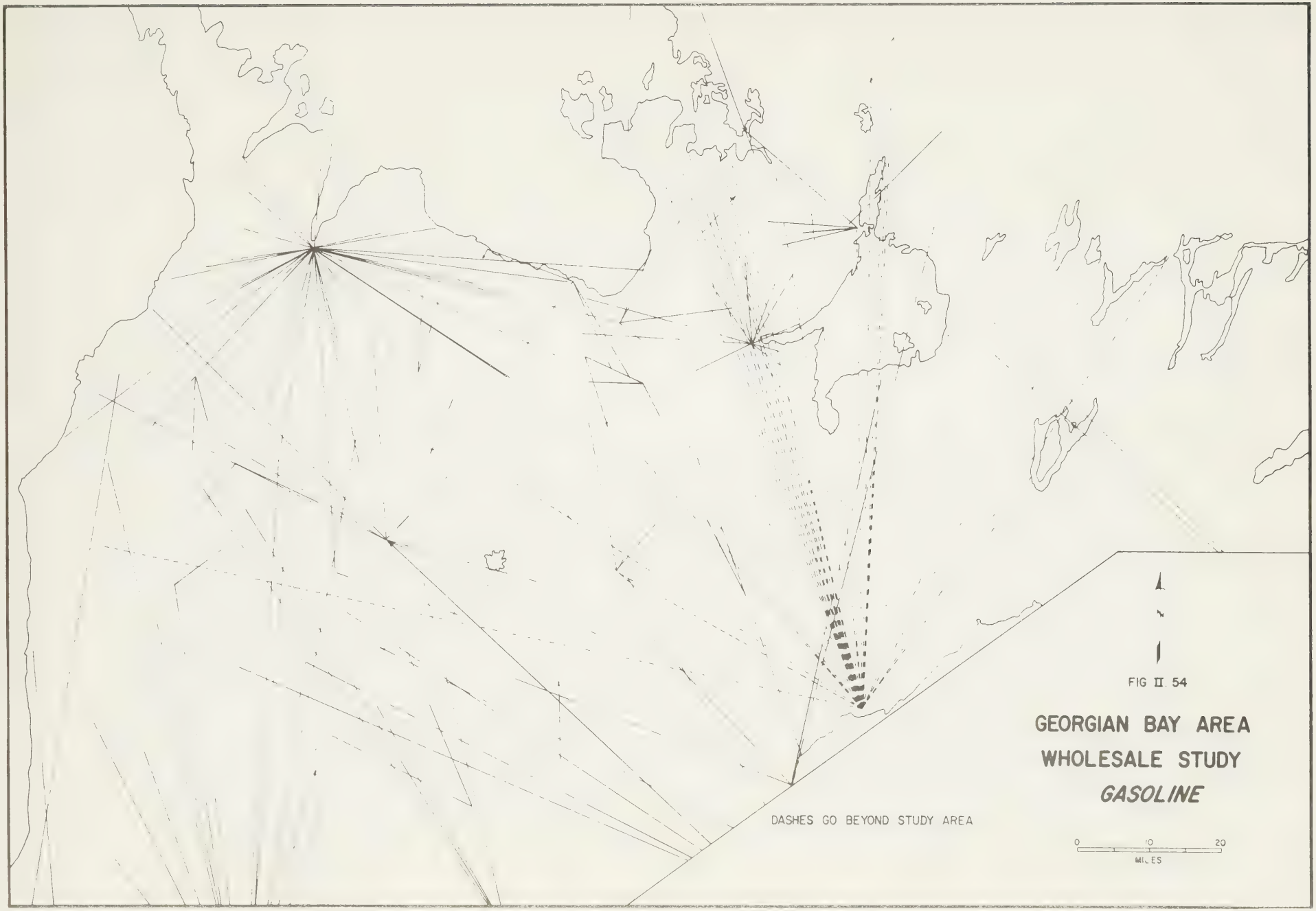


FIG II. 54

GEORGIAN BAY AREA
WHOLESALE STUDY
GASOLINE

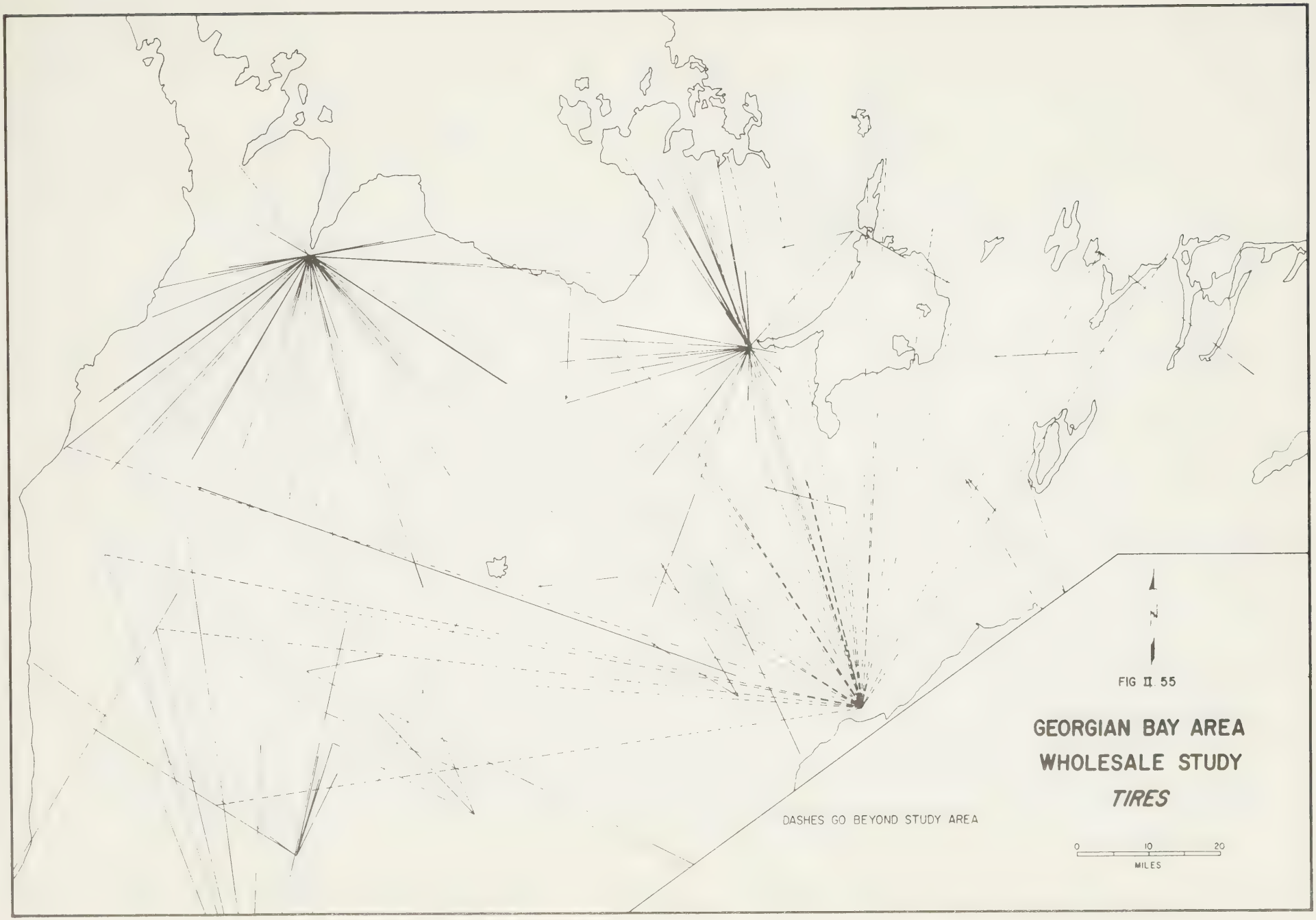


FIG II 55

GEORGIAN BAY AREA
WHOLESALE STUDY
TIRES

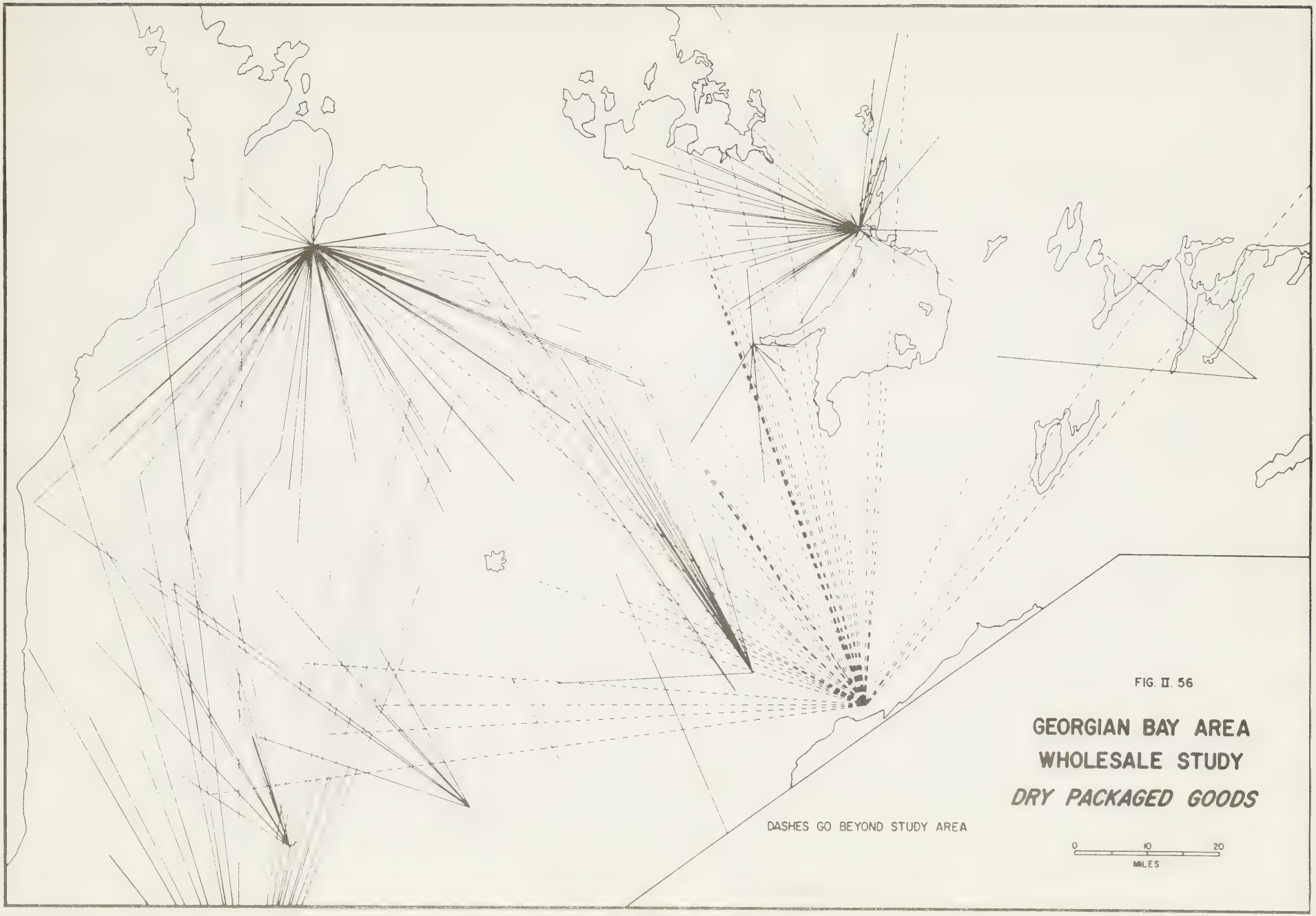
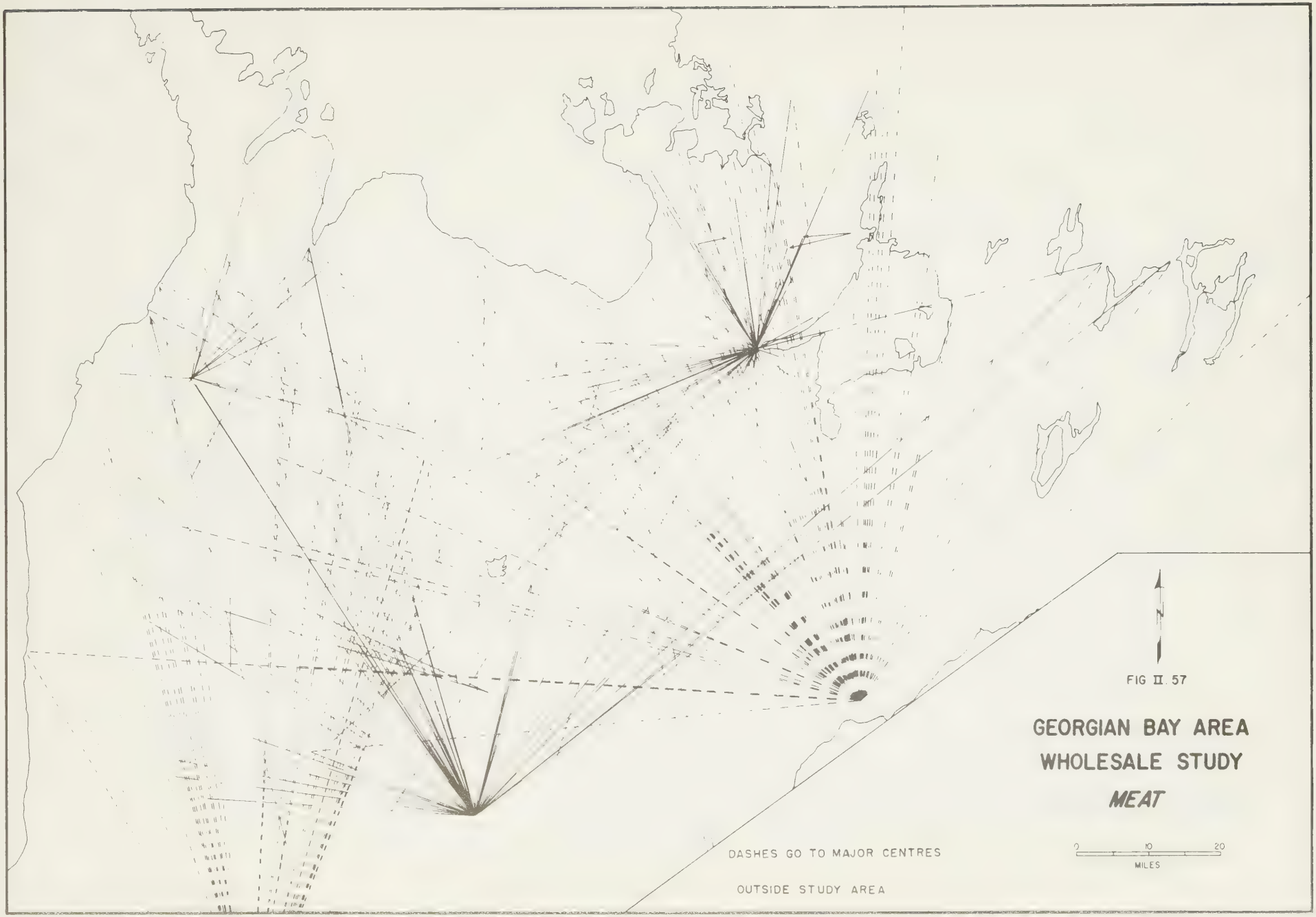
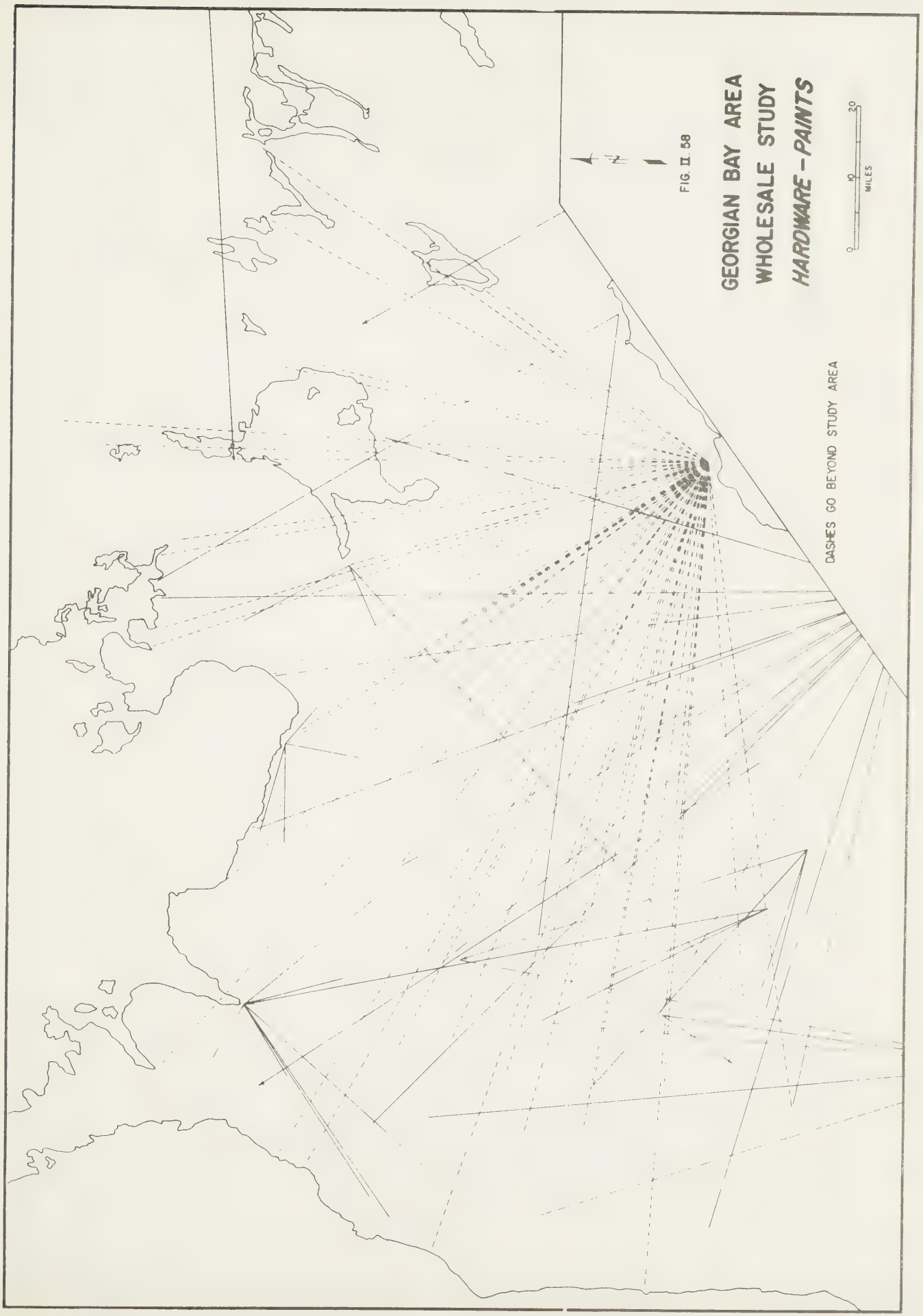
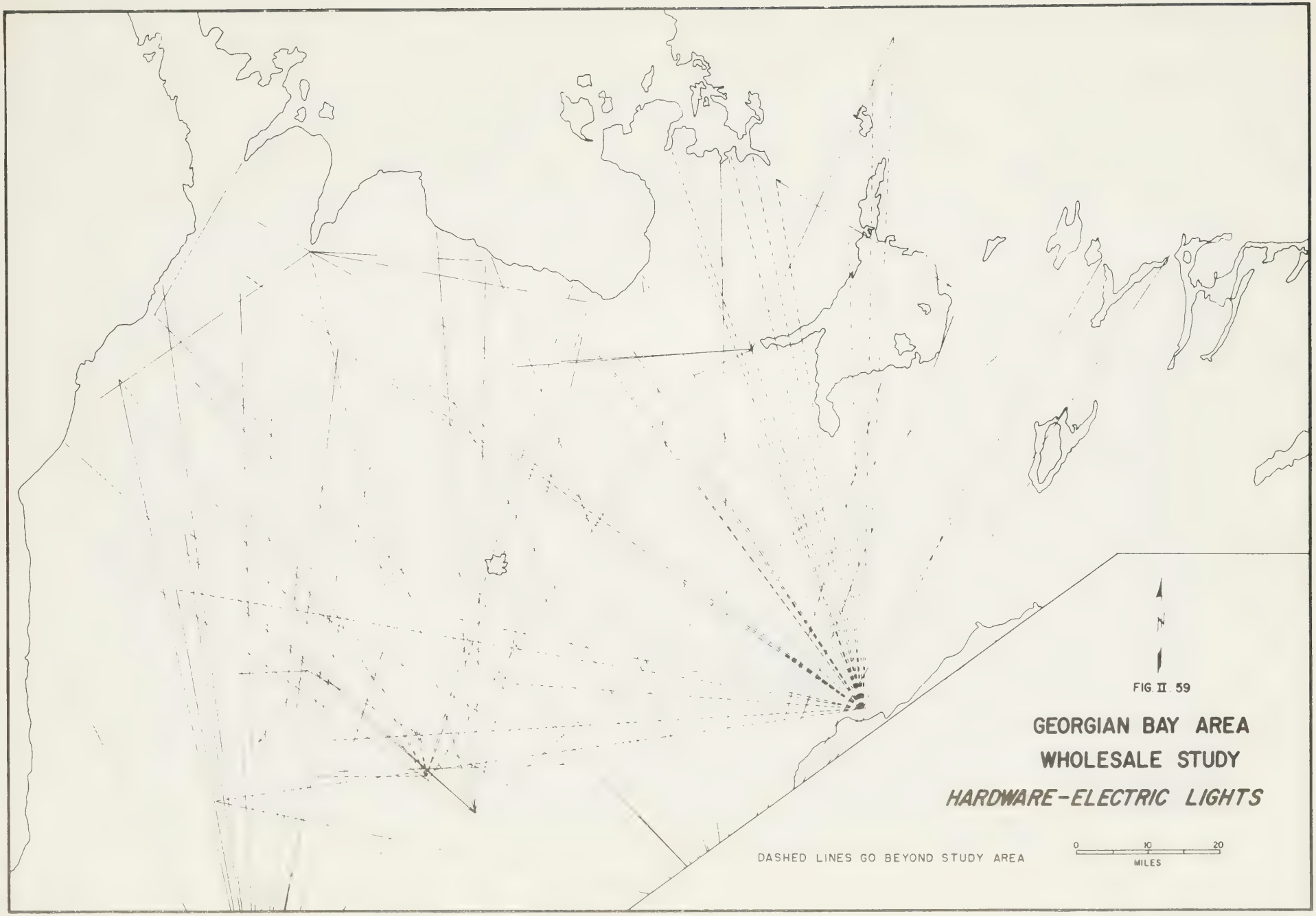


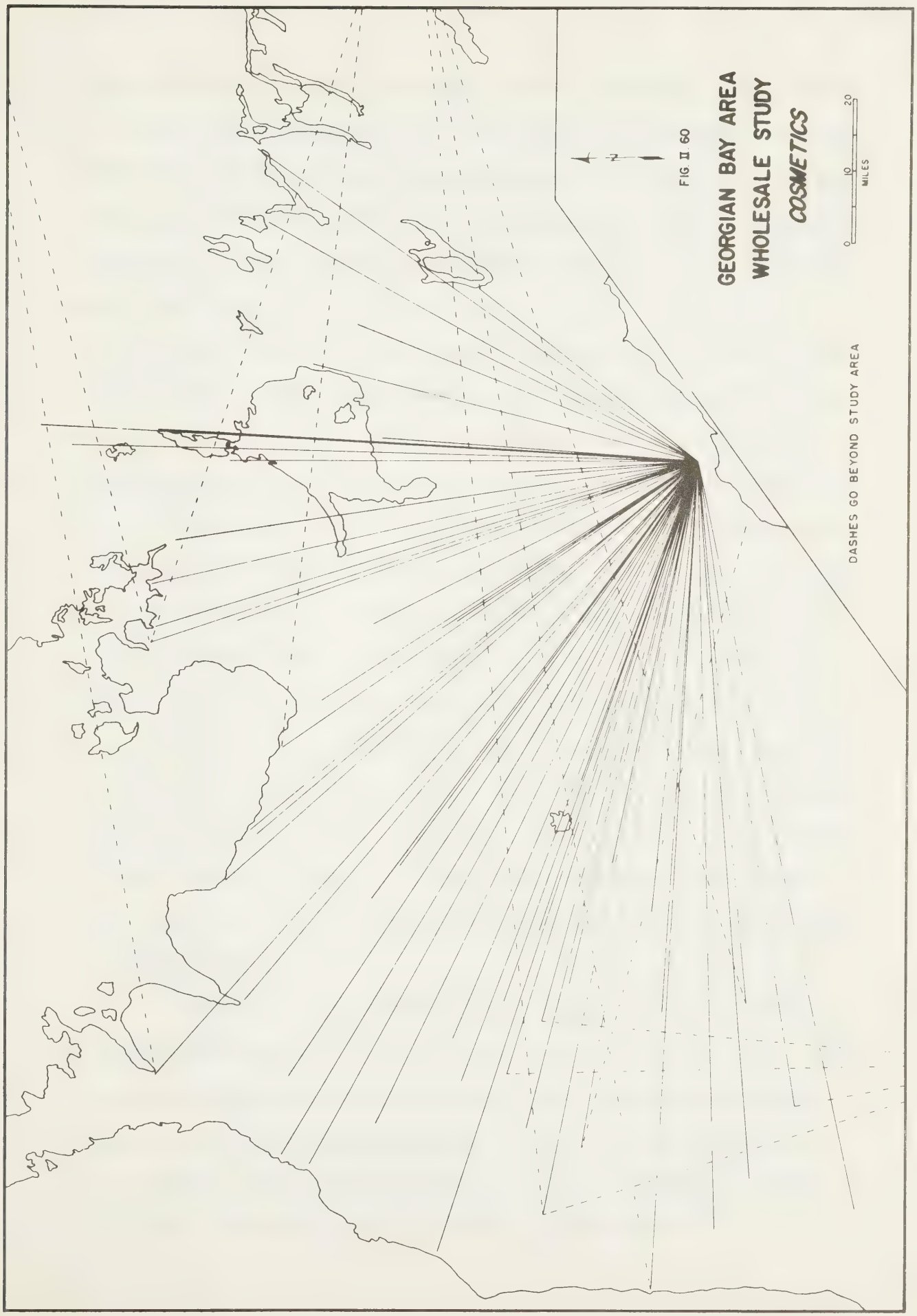
FIG. II. 56

GEORGIAN BAY AREA
WHOLESALE STUDY
DRY PACKAGED GOODS


N
FIG II. 57
GEORGIAN BAY AREA
WHOLESALE STUDY
MEAT
DASHES GO TO MAJOR CENTRES
OUTSIDE STUDY AREA
2
10
20
MILES


GEORGIAN BAY AREA
WHOLESALE STUDY
HARDWARE - PAINTS
FIG. II. 58
0
10
20
MILES
DASHES GO BEYOND STUDY AREA


N
FIG. II. 59
GEORGIAN BAY AREA
WHOLESALE STUDY
HARDWARE-ELECTRIC LIGHTS
DASHED LINES GO BEYOND STUDY AREA
0 10 20
MILES


GEORGIAN BAY AREA
WHOLESALE STUDY
COSMETICS
FIG. II 60
N
0
10
20
MILES
DASHES GO BEYOND STUDY AREA

ranked on the basis of frequency of supply occurrence. The lowest order wholesale function would seem to be that of milk, for many supply centres appear on the map (Figure II.52). Barrie is the only outstanding centre, and the influence of Toronto is not even apparent at the southern limits of the study area. Milk processing and distributing is the only wholesale activity found commonly at the town-level of the central place hierarchy.

Two wholesale activities enter the wholesale service hierarchy at the city level. These are lettuce, representing fresh vegetables, and gasoline. The maps (Figures II.53 and II.54) indicate well defined hinterlands for Owen Sound and Orillia (sub-regional centres) and Collingwood and Midland (city level centres).

Four wholesale activities enter the wholesale service hierarchy at the sub-regional level. These are tires, packaged goods, meat and paint. The wholesale desire line maps for tires and packaged goods reflect the great importance of Owen Sound, Barrie, and Orillia (Figures II.55 and II.56). It is interesting to notice the twin-city aspect of Barrie and Orillia with these wholesale activities, for services that one does not provide the other provides. At a slightly higher level, but still useful for demarcating sub-regional hinterlands, are the meat and paint wholesale hinterlands (Figures II.57 and II.58). On both these maps, the influence of Toronto is shown by a broken line, and although the impact of the large metropolitan centre is great, nevertheless both Barrie and Owen Sound emerge as strong sub-regional centres.

No one particular wholesale activity analyzed demarcates either primary or secondary wholesale-retail centres (regional and sub-provincial centres). Of the wholesale activities used the centres for electric light bulb distribution (Figure II.59), brooms and mops (domestic cleaning supplies) and nuts, bolts, nails, and screws (small carpenters' items) best delimit both the primary and secondary wholesale-retail centres. More investigation is required to determine which wholesale

functions best delimit each of the classes.

Drug store supplies (such as toothpaste, behind-the counter drugs, aspirin, and cosmetics) originate directly from large metropolitan centres, which in Canada are usually provincial capitals (Figure II.60). Thus, these criteria should best be used to delimit the wholesale trade area of highest order centres.

There is, of course, one theoretic class of centre above this — the administrative-financial-wholesale-retail centre, which is present neither in Canada nor the United States. London, England, and Paris, France, are two examples.

A Wholesale Activity Delimitation of the Southern Boundary of the Georgian Bay Region

The criteria used for the delimitation of the wholesale region of the Georgian Bay area are therefore those activities that enter the functional hierarchy at the town and city level of central places. These have been indicated to be milk, gasoline, and lettuce (a representative of fresh vegetables).

The position of the lines of equi-competition of these wholesale activities with respect to the hinterlands of non-Georgian Bay area towns and villages are presented in Figure II.61 .

The mean line of equi-competition, constructed by a process of distance averaging is indicated by the solid black line (Figure II.61). This line can therefore be regarded as the limit of the southern boundary of the Georgian Bay Region based on wholesale criteria.

THE JOURNEY-TO-WORK PATTERN AS A CRITERION OF DELIMITATION

Especially because it shows the day-by-day influence exerted by a centre of employment upon a surrounding area, the journey-to-work pattern is a

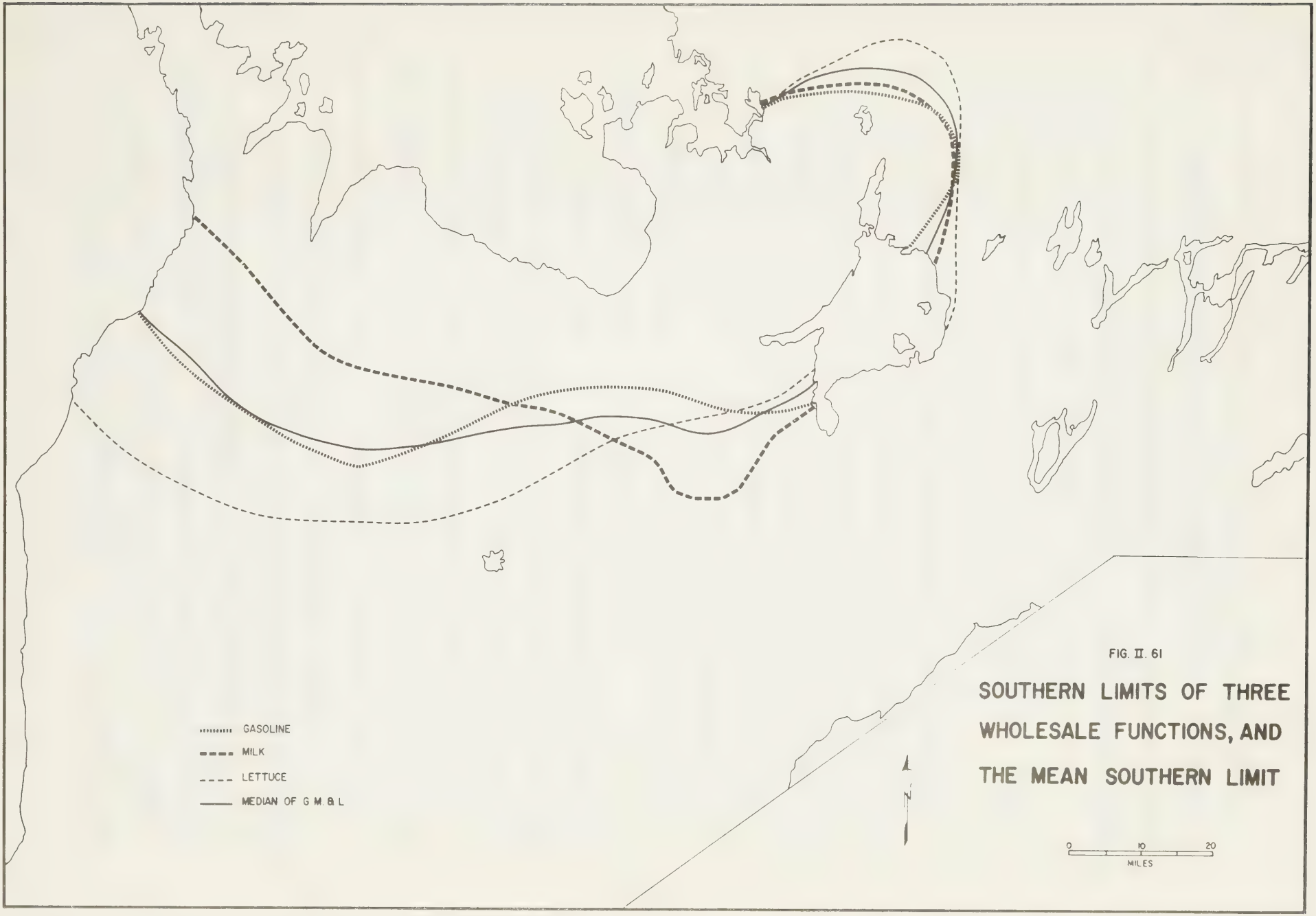


FIG. II. 61

SOUTHERN LIMITS OF THREE WHOLESALE FUNCTIONS, AND THE MEAN SOUTHERN LIMIT

fundamental criterion in delimiting regions for purposes of alleviating economic stress. Indeed, the daily range of commuting to employment places this criterion in an important position among all criteria for such purposes, inasmuch as an effort to alleviate economic stress by providing employment in a centre can extend spatially as far as, but no farther than, the range of that centre's employment influence. Such a range will change with time and technology, but is rather sharply defined at any given time.

The data used in this analysis have been obtained from direct field interviews with the largest manufacturing companies in each centre visited Thus, the journey-to-work hinterland developed from this data should be interpreted primarily as journey-to-work regions for manufacturing. However, data collected by Thoman in eastern Ontario and Quebec suggest that manufacturing regions are in fact a good representation of commuting in all occupational groupings (footnote 4). Therefore, the journey-to-work hinterlands developed from the manufacturing data can be considered to have much wider implications.

One basic problem in the collection of the journey-to-work data was the variability of the commuting patterns for very small centres where manufacturing is poorly developed. As a consequence, it was deemed necessary to decide at the outset which centres should be considered to be stable manufacturing towns and which should not. The term "stable" has, of course, many definitions, but in this meaning described here, it refers to a relationship which might have predictive interpretations. From Figure II.62 it can be observed that the population of a centre and the manufacturing employment in a centre are much more easily predicted when the centre has more than 2000 people and more than 350 manufacturing employees than when it does not. The inset graph in Figure II.62 clearly indicates the tremendous variability in the data for small centres. Therefore it was decided to use only those centres with more than 2000 people, and more than 350 employees

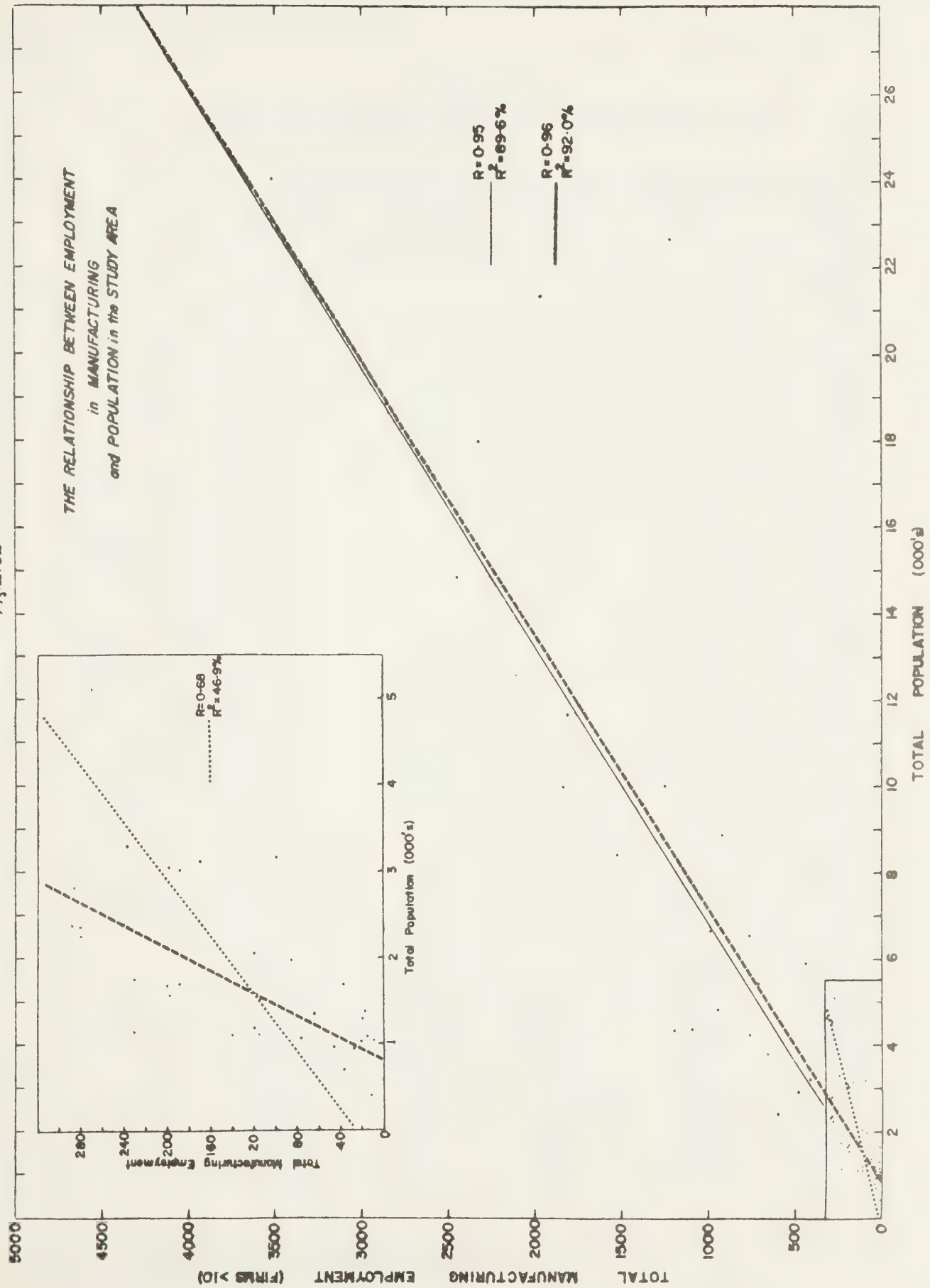

THE RELATIONSHIP BETWEEN EMPLOYMENT
in MANUFACTURING
and POPULATION in the STUDY AREA
R=0·95
R²=89·6%
R=0·96
R²=92·0%
TOTAL MANUFACTURING EMPLOYMENT (FIRMS >10)
TOTAL POPULATION (000's)
R=0·68
R²=46·9%
Total Manufacturing Employment
Total Population (000's)

Fig II.62

TABLE II.11

Rationale for Expanding Samples in Journey-to-Work Study

Name	Est. Pop.	No. of Employed	J to W Sample	Sample Percent	Mult. Factor
Alliston	3,228	432	270	62.5	1.6000
Aurora	10,046	1,255	838	66.7	1.49761
Barrie	24,010	3,559	895	25.2	3.97653
Collingwood	8,424	1,555	1,304	83.9	1.1924
Durham	2,419	613	493	80.4	1.24341
Fergus	4,336	1,198	450	37.6	2.66222
Goderich	6,556	761	363	47.7	2.096
Hanover	4,810	946	463	48.9	2.04319
Lindsay	11,627	1,833	643	35.0	2.85070
Listowel	4,382	1,108	787	71.0	1.40788
Meaford	3,801	659	497	75.4	1.32596
Midland	9,997	1,833	680	37.1	2.69558
Newmarket	8,869	925	925	100.0	1.0000
North Bay	22,633	1,223	479	38.8	2.58016
Orangeville	5,414	724	167	23.1	4.33533
Orillia	14,824	2,449	971	39.6	2.52214
Owen Sound	17,955	2,333	1,622	69.5	1.43835
Peterborough	53,424	13,700	7,072	50.9	1.93722
Sturgeon Falls	6,670	987	612	62.0	1.61275
*Walkerton	4,222	765	401	52.4	1.9077
Wingham	2,924	489	251	51.3	1.948

Source: Calculated by author from field data.

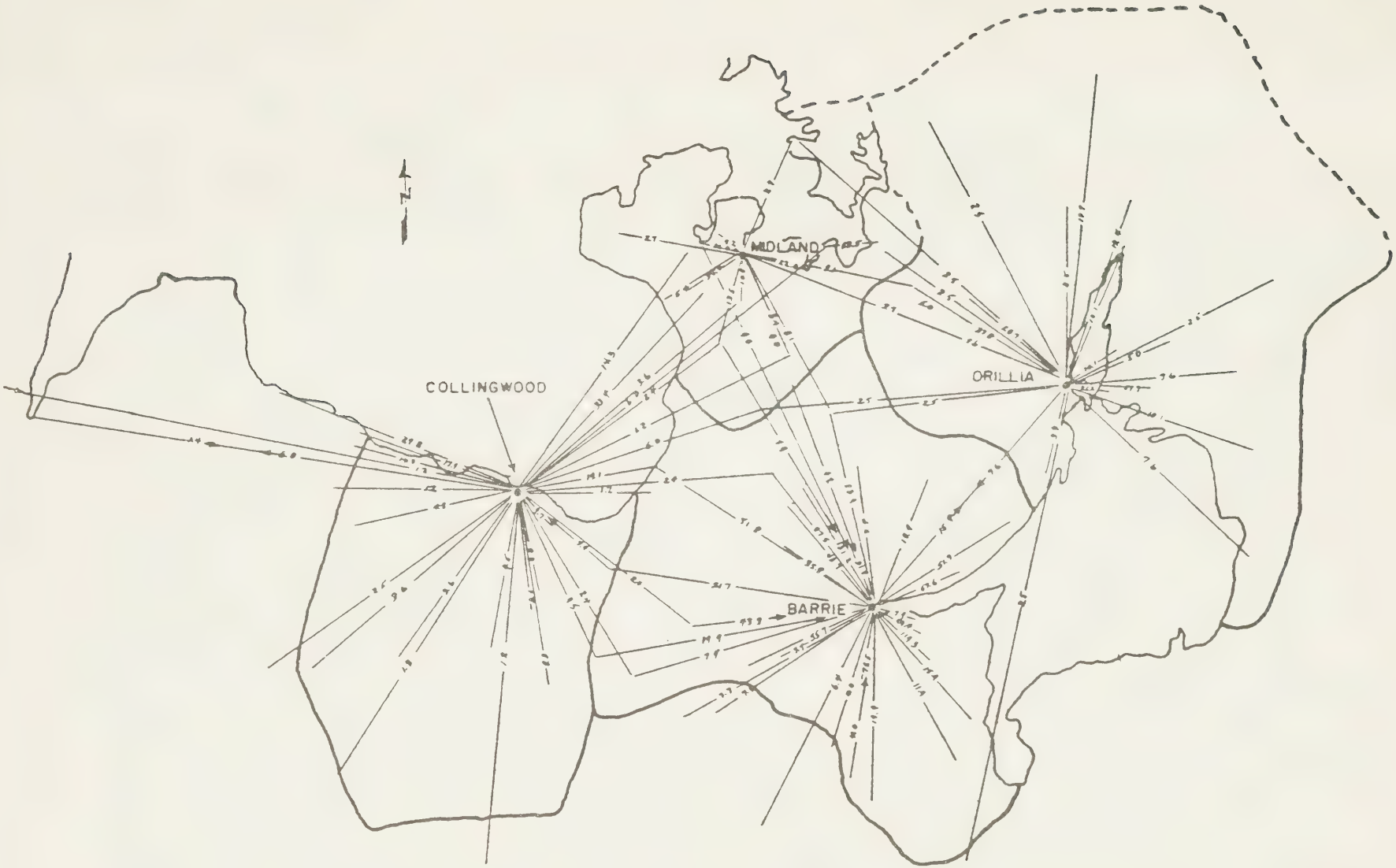


FIG. II.63 - SAMPLE MAP FOR DELIMITING JOURNEY-TO-WORK REGIONS IN THE GEORGIAN BAY AREA. Information pertains only to competition among Collingwood, Barrie, Orillia, and Midland. Lines from and to other centres are not shown. Sample percentages are expanded to 100 (Table II.11). Lines originate from post offices of centres and of rural free delivery routes. In drawing the final boundary, attention was given first to volume of commuting among competing centres, secondly to road patterns and sizes and shapes of rural free delivery zones, and thirdly to physical features. Dashed lines are estimates based on incomplete evidence.

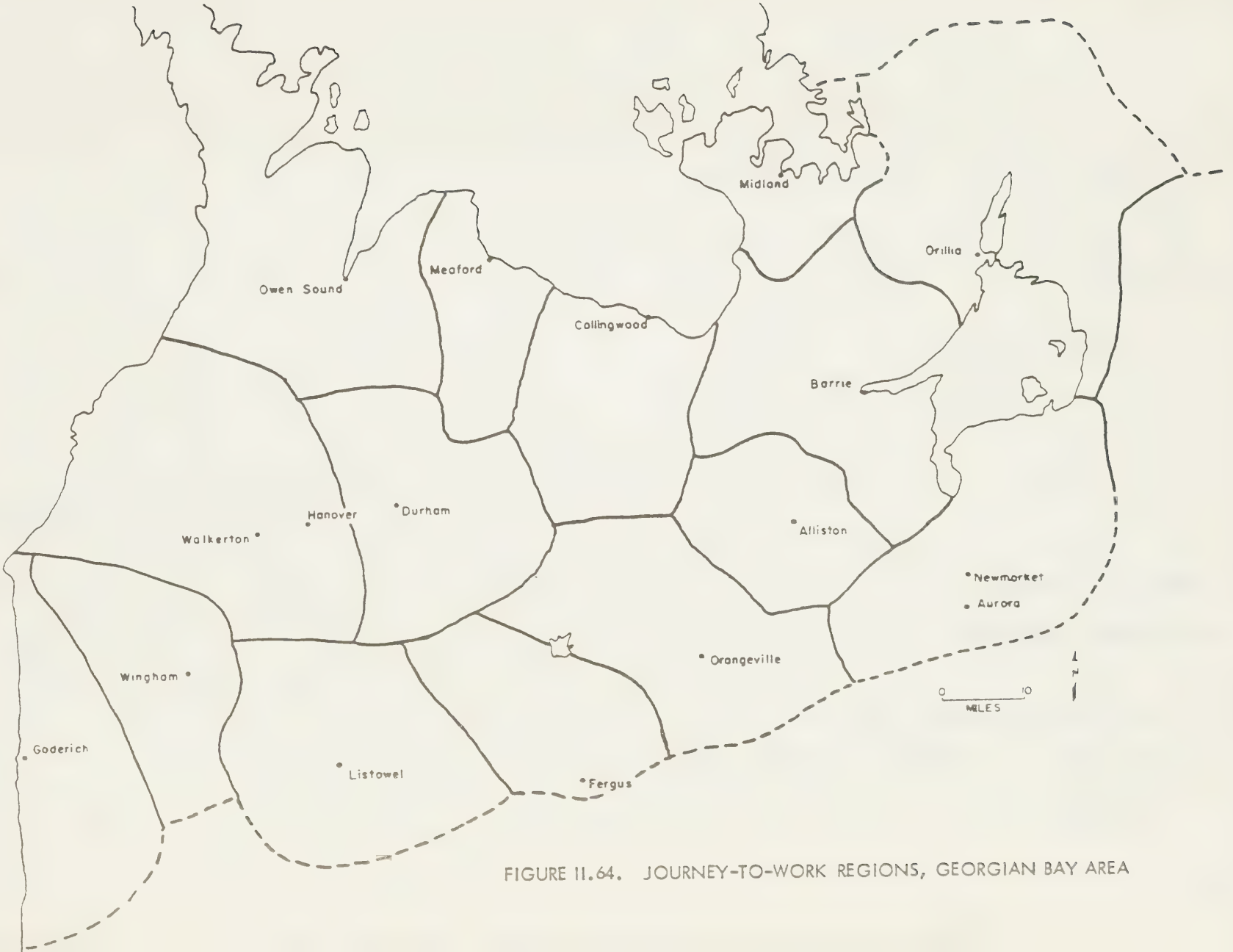


FIGURE II.64. JOURNEY-TO-WORK REGIONS, GEORGIAN BAY AREA

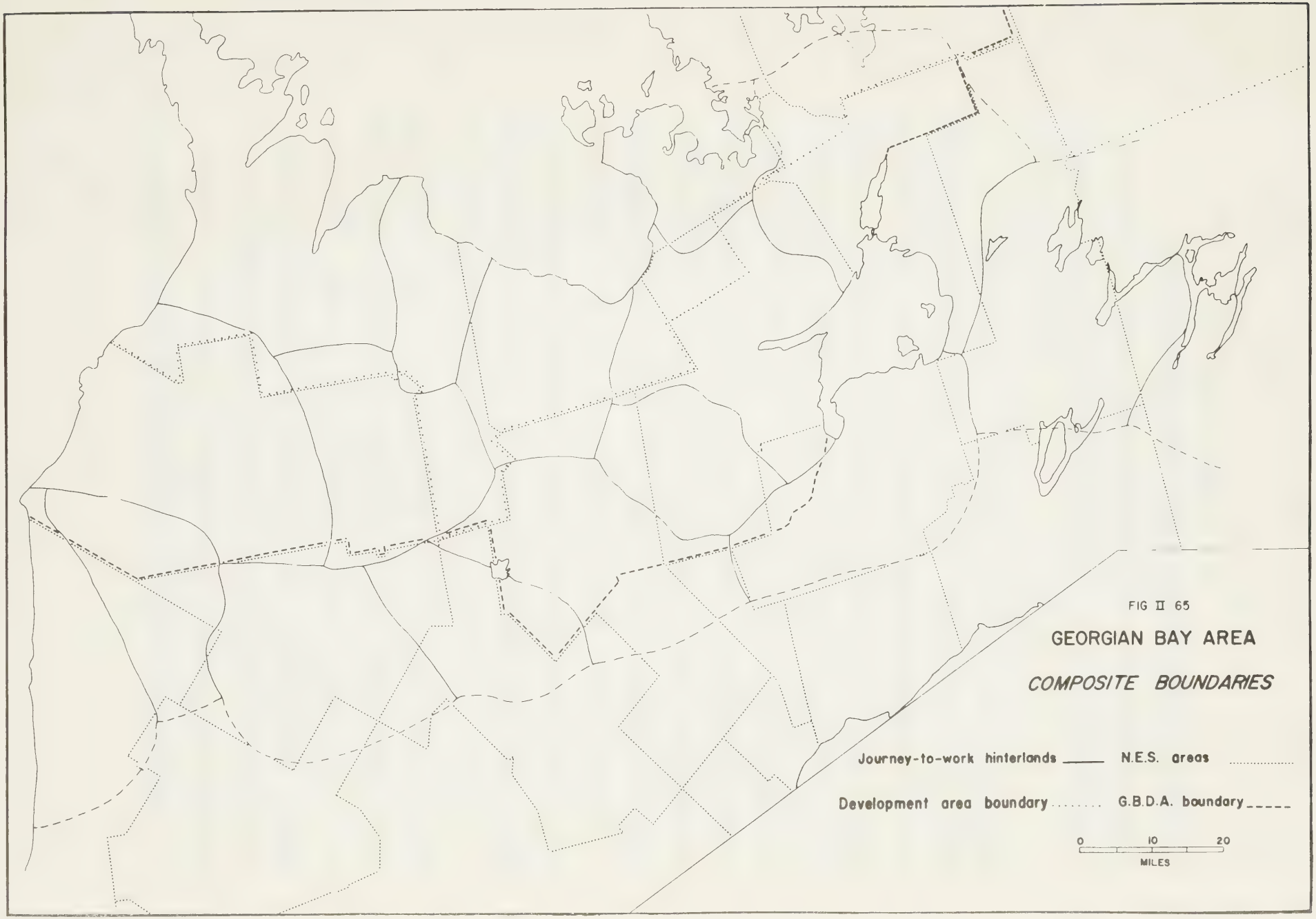


FIG II 65
GEORGIAN BAY AREA
COMPOSITE BOUNDARIES
Journey-to-work hinterlands
N.E.S. areas
Development area boundary
G.B.D.A. boundary
0
10
20
MILES

in manufacturing in the journey-to-work analysis.

An interesting implication of the relationship expressed in Figure II.62 is that there is some consistent relationship between the manufacturing employment in a centre and the total population of the centre. This implication merits further investigation.

The data were collected by obtaining a complete enumeration of the location of employees (aggregated to centres) for the two largest manufacturing companies in each centre. Thus, the sample percentage varied according to the dominance of the largest companies in the manufacturing employment of centres (Table II.11). Comparability was achieved by multiplying the sample flow from a point to a manufacturing centre by a factor that would expand the sample to a 100% enumeration (Table II.11). These flows were then plotted on maps (Figure II.63), and lines were drawn around the manufacturing centres to delimit regions where a particular centre dominated the work force. This journey-to-work map is shown in Figure II.64. The journey-to-work boundaries are compared with boundaries of the Area Development Agency, National Employment Service Areas, and the southern boundary of the Georgian Bay Development Association in Figure II.65. With respect to the Georgian Bay vicinity, there is a relatively close coincidence of A.D.A. and N.E.S. boundaries with the journey-to-work boundaries in the western portion of the area shown, but not so close a matching in the eastern portion. Especially around Barrie and Orillia, two critical towns in the area shown, the boundaries vary noticeably. N.E.S. boundaries allow too generous an area to Barrie to the southwest and the northeast, and restrict Orillia too much except to the northwest. The present A.D.A. boundaries slice off the northwestern portion of the normal commuting zones of both Barrie and Orillia.

DELIMITATION OF THE GEORGIAN BAY REGION

Quite different approaches were utilized in delimiting the boundary of the southern section of the Georgian Bay Region from those used in delimiting the boundary of the northern section (Figure II.2). Because the southern section is by far the more highly populated (Figure II.3), all criteria of Figures II.3 - II.61 were carefully considered. Inasmuch as Figure II.50 (Mean Line of Equi-competition for Eight Retail Functions and the Three Highest Order Retail Functions) summarizes Figures II.21 - II.49, and Figure II.61 (Mean Line of Equi-competition for Three Wholesale Activities) summarizes Figures II.51 - II.60, these were important considerations in drawing the final line. They were superimposed on a single work map, and a mean line drawn between them. This line was then placed on a work map together with the southern limits of journey-to-work regions of centres located on or near Georgian Bay (Figure II.64). A mean line then was drawn between the composite retail-wholesale line on the one hand, and the southern journey-to-work line on the other. That line was further inspected with respect to population densities and manufacturing concentration, and plotted as the southern limit of the Georgian Bay Region (Figures ii.66 and ii.67). The final line is particularly well documented within the southern section of the over-all Georgian Bay study area (Figures II.2 and II.67). If subdivision were necessary, it could be done rather simply by aggregating journey-to-work regions. Particular attention could be paid to concentration of population (Figures II.3 - II.5) and manufacturing (Figures II.7 - II.14) in delimiting subregions.

In the northern section of the study area, Sudbury stands out not only because of its size but also because of its distance from other centres which might act as competitors. A delimitation of the Sudbury umland (primary trading area) has been made

FIG. II.66

FINAL BOUNDARY GEORGIAN BAY REGION

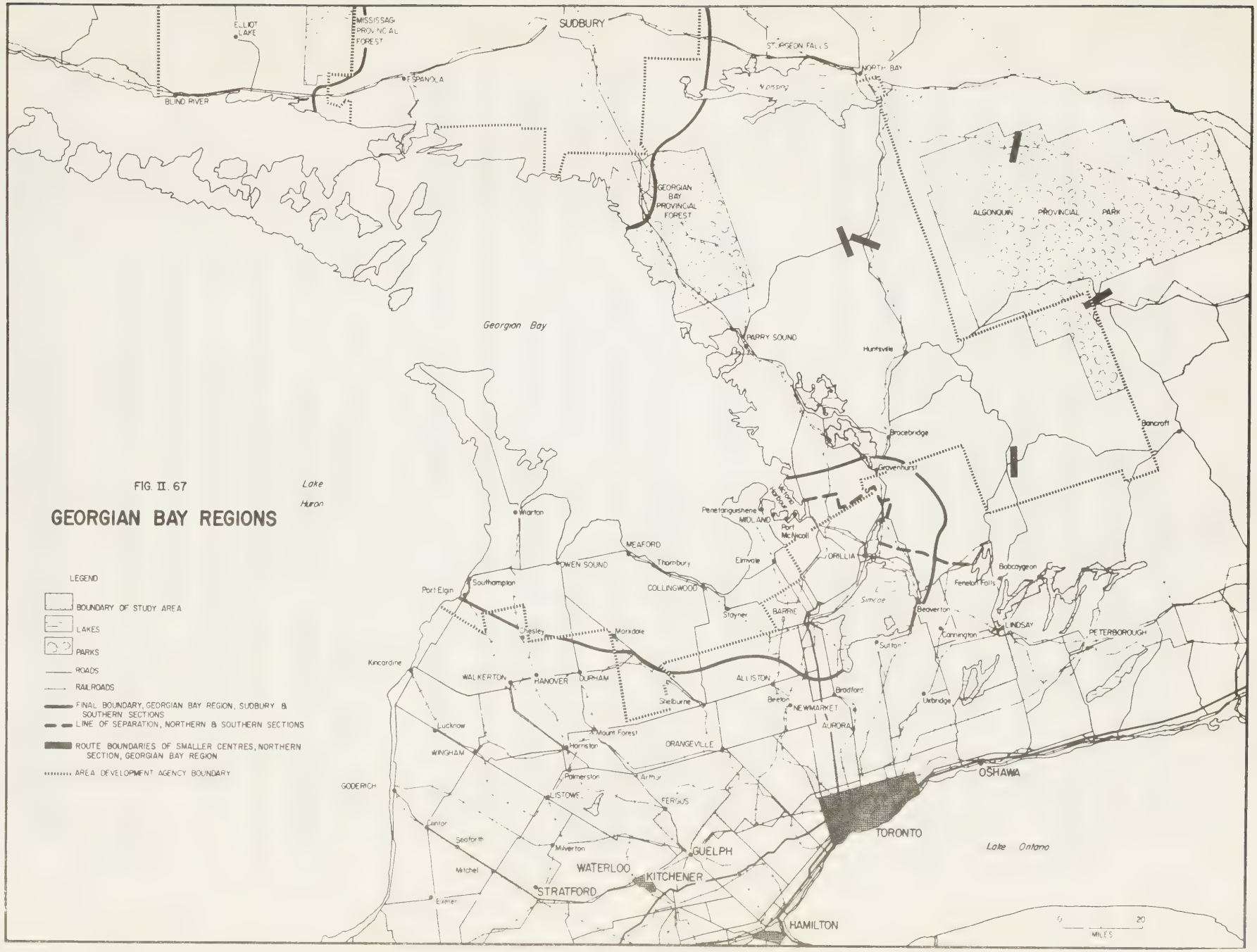


FIG. II. 67

GEORGIAN BAY REGIONS

LEGEND

- BOUNDARY OF STUDY AREA
- LAKES
- PARKS
- ROADS
- RAILROADS
- FINAL BOUNDARY, GEORGIAN BAY REGION, SUDBURY & SOUTHERN SECTIONS
- LINE OF SEPARATION, NORTHERN & SOUTHERN SECTIONS
- ROUTE BOUNDARIES OF SMALLER CENTRES, NORTHERN SECTION, GEORGIAN BAY REGION
- AREA DEVELOPMENT AGENCY BOUNDARY

by Saarinen[10]. The southern limits of the Sudbury region as interpreted by Saarinen are shown in Figure II.67, together with outer limits of influence of smaller centres in the northern section of the study area as indicated in interviews with Yeates in those centres. Clearly, delimiting functional regions in this northern section involves establishing zones of influence from these centres as well as those still farther north on Highways 11 and 65. Journey-to-work patterns would be especially important in such delimitation, and it is unlikely that these will exceed the 35-mile range now prevailing in the southern section and in eastern Ontario.

REGIONAL VIEWPOINT OF LOCAL RESIDENTS

In keeping with methodological statements of a new and growing branch of geography that is concerned with man's perception of his environment, an effort was made in the Georgian Bay study to learn the viewpoints of selected inhabitants of localities concerning regional affiliation. Questionnaires were sent to the mayors and town clerks of all centres of 1,000 or over in the southern section of the study area. Of the recipients, 52 per cent responded. Three questions were asked:

1. Ignoring all existing regions, with what general region do you believe your community is associated economically and socially?
2. Ignoring existing regional boundaries, with which of the existing Province of Ontario Economic Regions do you believe your community is most closely associated?
3. With which neighboring communities do you believe your commu-

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10. Saarinen, Oiva W., A Geographical Basis for Regional Planning in the Sudbury Area. (Unpublished M.A. Thesis, Department of Geography, University of Western Ontario, 1966).

nity has regional ties so strong that a regional boundary should not be drawn between those communities and your own?

The first question was intended as a substitute for a specific query as to whether a community believes it should be included in a designated area of the Area Development Agency. The question was worded in a general way to avoid possible influence upon the respondent by the thought of being included within or excluded from a development area. Unfortunately, the question was worded in terms too general to be of value, as the responses ranged widely. Results of the second and third questions are mapped in Figures II.68 and II.69. These maps should be viewed against the reservations that a very few residents of each locality were contacted and that only slightly over one-half of the queried communities responded. Nevertheless, the maps are of interest. With respect to Figure II.68, the existing boundary of the Area Development Agency region includes two and one-half communities that declare an orientation to the south, and exclude a number of communities declaring an affiliation with Georgian Bay. The effect of the Provincial regional boundaries may be seen in that there is a relatively close correspondence between these boundaries and declarations of orientation.

The community of interest map (Figure II.69) also must be interpreted cautiously inasmuch as coverage is spotty. However, it does suggest a break in linkages at the approximate boundary of the Georgian Bay Region as delimited in this study.

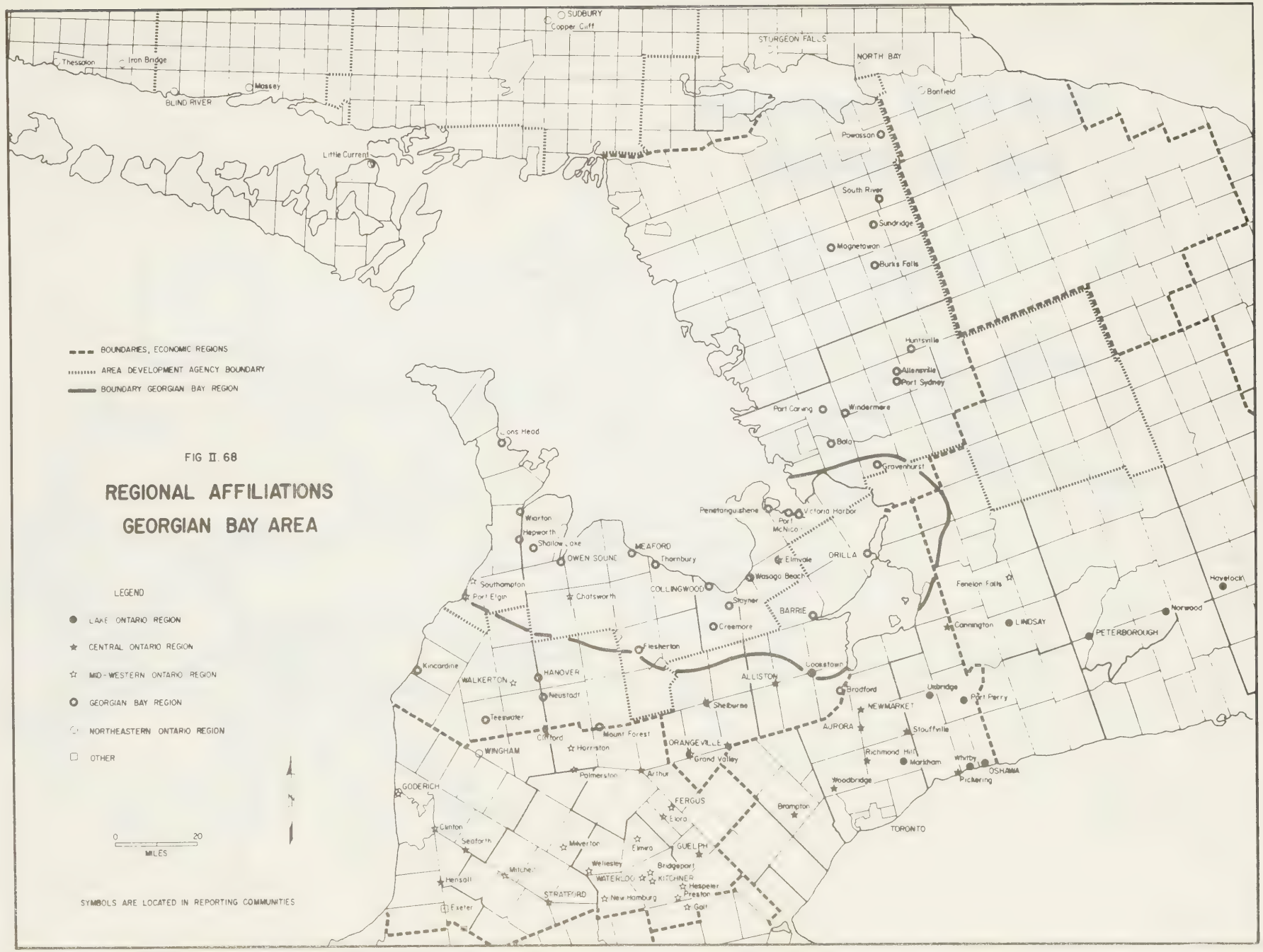
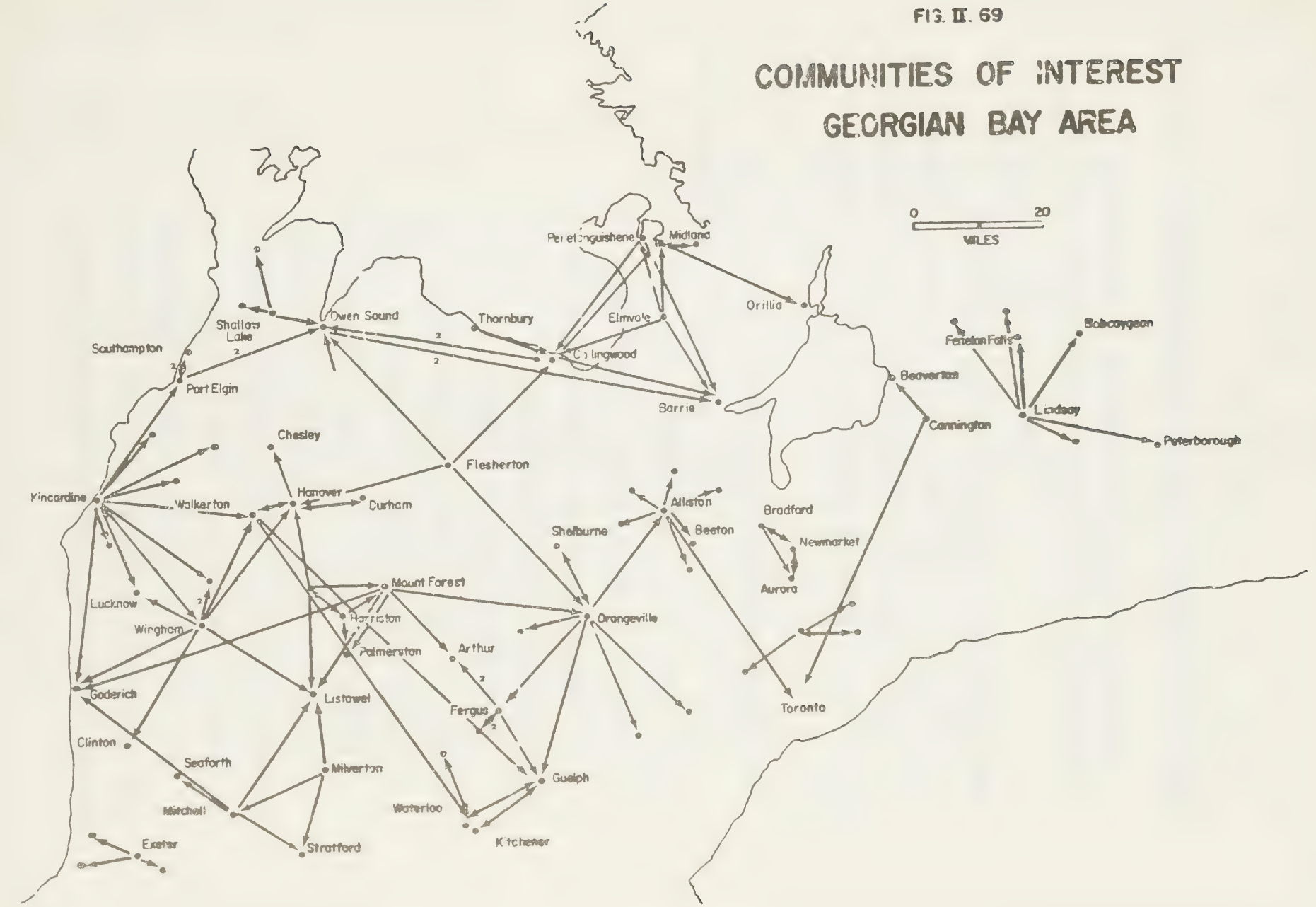

SUDBURY
Copper Cuff
STURGEON FALLS
NORTH BAY
Bonfield
Thessalon
Iron Bridge
Massey
BLIND RIVER
Little Current
Powassan
South River
Sundridge
Magnetawan
Burks Falls
Huntsville
Allensville
Port Sydney
Port Carling
Windermere
Bala
Gravenhurst
Lions Head
Wiarton
Hepworth
Shallow Lake
OWEN SOUND
MEAFORD
Thornbury
Penetanguishene
Port McNicoll
Victoria Harbor
Elmvale
ORILLIA
Wasaga Beach
Southampton
Port Elgin
Chatsworth
COLLINGWOOD
Stayner
Creemore
BARRIE
Fenelon Falls
Haverlock
Norwood
Cannington
LINDSAY
PETERBOROUGH
Fesherton
Kincardine
WALKERTON
HANOVER
Neustadt
ALLISTON
Coolestown
Brodford
Uxbridge
Port Perry
NEWMARKET
Shelburne
Teeswater
Clifford
Mount Forest
AURORA
Stouffville
WINGHAM
Horriston
ORANGEVILLE
Grand Valley
Richmond Hill
Markham
Whitby
OSHAWA
Pickering
Palmerston
Arthur
Woodbridge
GODERICH
FERGUS
Elora
Brampton
Clinton
Seaforth
Milverton
Elmira
GUELPH
TORONTO
Wellesley
Bridgeport
Mitchell
WATERLOO
KITCHENER
Hespeler
Hensall
STRATFORD
New Hamburg
Preston
Galt
Exeter
BOUNDARIES, ECONOMIC REGIONS
AREA DEVELOPMENT AGENCY BOUNDARY
BOUNDARY GEORGIAN BAY REGION
FIG II. 68
REGIONAL AFFILIATIONS
GEORGIAN BAY AREA
LEGEND
LAKE ONTARIO REGION
CENTRAL ONTARIO REGION
MID-WESTERN ONTARIO REGION
GEORGIAN BAY REGION
NORTHEASTERN ONTARIO REGION
OTHER
0
20
MILES
SYMBOLS ARE LOCATED IN REPORTING COMMUNITIES

FIG. II. 69

COMMUNITIES OF INTEREST
GEORGIAN BAY AREA



CHAPTER III

GENERAL PRINCIPLES FOR DELIMITATION OF DEVELOPMENT REGIONS

From experience in the Georgian Bay vicinity and from previous experience in delimiting and assisting development areas, the authors offer the following general principles of delimitation:

1. Delimitation on a nation-wide basis will depend heavily upon data available from existing sources and from sample surveys. Other means of delimitation may be used in ways outlined below, but the primary criteria will involve data available periodically on a nation-wide basis by standardized spatial units.

2. Identification of economic stress should reveal, in fine spatial detail, the geographical distribution of such stress.

   a. The major criteria should be those currently in use by the Area Development Agency. These reveal intensity and trends in unemployment, and level of family income, compared with national norms. In the authors' opinion, the indices of such stress can be traced directly and indirectly to these two.

   b. A secondary criterion useful in exceptionally critical decisions should be differential rates of population change compared with national norms. It would be unfortunate, in our judgement, if this criterion were to be raised to the level of those discussed in (a) above, inasmuch as it probably is affected by changes in those criteria — is, in other words, a dependent variable. However, population change is an added dimension for making decisions as to whether certain areas ought, or ought not, to be designated. Other factors being equal and given the announced

objectives of the Area Development Agency (Chapter I), one might consider using population change in making decisions where unemployment and family income criteria are close to established norms. Under those circumstances, places experiencing losses of population or very slow rates of population increase might be given serious consideration as qualifying for development area status.

c. The data used for judging the status of development areas ought to be reported as frequently as possible, optimally on a monthly basis.

d. The data should refer to places of residence, and not places of employment.

e. The spatial size of reporting units should range as follows:

(1) Census information and sample data should be available on a block basis for all urban and suburban areas.

(2) For non-urban areas, thorough coverage is especially important to the Area Development Agency for purposes of detailed identification of conditions of economic stress. Recommended grid cells are related to population density as follows:

Population Density (persons per square mile)	Size of Grid Cell (square miles)
Less than 10	100 plus
10 - 19.9	36
20 - 29.9	25
30 - 39.9	16
40 - 49.9	9
50 - 59.9	4
60 plus	1

Under special circumstances where clusters of population

density occur in otherwise sparsely populated areas, these clusters should be isolated and plotted according to the scale recommended above.

f. Inasmuch as the recommendations of point (e) above, cannot be implemented immediately, it is recommended that as much data as possible be reported and recorded from each National Employment Service Office so that information on employment, family income, and population change be maintained on as detailed a spatial coverage as possible.

3. Delimitation for alleviation of economic stress should involve urban-centred regions, except in unusual cases where resource industries and rural tourism are very important.

a. The degree of precision in such delimitation will vary with the time and money invested. The journey-to-work region is the most important single criterion, inasmuch as it reveals the day-by-day employment influence of a centre. This region can be approximated by plotting the journey-to-work patterns of one or two very large manufacturing firms in a locality. Further field study on more firms, including tertiary activities, will of course add more precision. Indices of retail and wholesale trading hierarchies add very important dimensions to such delimitation, although much information would be necessary from special studies or new data (other than that presently available) gathered during census taking periods and sample surveys. Commodity flow would be an important additional criterion if it were available.

b. Urban-centred regions should first be plotted individually, then aggregated, in view of conditions of stress revealed in 2 (a-e), above. A procedure for selecting centres is recommended in the journey-

to-work section of this report. The degree of aggregation will vary with spatial distribution of conditions of stress to be alleviated. The final pattern of single or aggregated urban-centred regions should cover all grid cells of conditions of stress. In the aggregation process, two aspects of manufacturing and tertiary activities in selecting possible "growth points" emerge:

(1) Considered by Standard Industrial Classification, what number and kinds of selected activities exist in a centre compared with the number and kinds that might be expected in a centre of a given population size? This "threshold principle" is demonstrated in Table II.5 insofar as it applies in preliminary survey to manufacturing in the Georgian Bay study region.

(2) What has been the natural growth tendencies of a centre? These may be isolated in a number of ways, one of the simplest of which is by counting and classifying the activities which have been attracted to a centre within the past five years, compared with the total activities of that centre, measured by labour force[11].

c. The location of rural-oriented resource and tourist industries should be within commuting range of places with economic stress (point 2, page 120), if possible.

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11. Thoman, Richard S. The Changing Occupance Pattern of Missouri, Kansas, and Oklahoma. Chicago: Department of Geography Research Paper No. 33, 1953. See especially pp. 87-94. See also: Semple, Robert K., A Quantitative Separation and Analysis of Spatial Trends in the Viability of Small Urban Centres in Southern Ontario. (Unpublished M.A. Thesis, Department of Geography, University of Toronto, April, 1966.

APPENDIX

THE APPLICATION OF AERIAL PHOTOGRAPHS TO THE DEFINITION OF A REGION

by

Gerald McGrath

Without doubt, the aerial photograph constitutes a valuable tool in the hands of capable interpreters, other things being equal. However, careful thought is required as to the potential application of this tool to the central purpose of any project, and particularly to the relationships between the photograph as a source of information and other sources of data.

At the outset, it was accepted that:

1. Certain of the criteria selected for the delimitation of the Georgian Bay Region would not be susceptible to analysis using the aerial photograph;
2. Available photography would be variable in age, scale and quality, and hence utility would vary accordingly;
3. The sheer volume of available photography would preclude exhaustive interpretation;
4. The use of aerial photography would depend upon the progress of the project and the availability of other sources of information, e.g. statistical data, thematic mapping, special reports, and theses.

A survey was made of photography available in the National Air Photo Library, Ottawa, and from the Ontario Department of Lands and Forests, which confirmed point (2) above. The dates of the provincial photography at 20 chains to the inch, 1:15,840, which covered the area of study, ranged between 1953 and 1964, although only Manitoulin Island and the area west of Elliot Lake was covered by photography exposed since 1960.

Photography exposed on behalf of the Federal Government by contractors varies considerably in scale and in age, ranging from photography at approximately 1 inch to the mile dated 1951 of the northwestern part of the study area, to photography of parts of the southern portion at approximately 1:16,000 exposed in the early 'sixties.

THE NATURE OF THE PROBLEM: WHAT IS REQUIRED OF THE PHOTO INTERPRETER

It should be made clear that there is a distinction between photogrammetry and the interpretation of aerial photographs, although the latter is a constant companion of the former in the creation of modern topographic maps by photogrammetric means. Photogrammetry constitutes the science of measurement from aerial photographs, and as such, is intimately related to the perspective geometry of the aerial photograph. The results comprise precise measurements of horizontal and vertical distances, from which maps may be ultimately constructed. Air photo interpretation involves the identification and interpretation of individual photographic images, and the development of a system for the analysis of photographic imagery. It is the process of air photo interpretation which is of relevance to the project in question.

The Application of Air Photo Interpretation to Functional Region Criteria

Insofar as the emphasis is upon linkages and movements, the application of the technique is severely restricted. The interpretation of the individual photographs or of controlled or uncontrolled mosaics[1] makes possible the recognition of transportation routes and connections between places. However, it is clear that the process of

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1. "Mosaics. Mosaics are pictures made by assembling a number of photographs. The assemblage is usually rephotographed and may be reprinted at any scale." Spurr, S.H., Photogrammetry and Photo Interpretation. New York: The Ronald Press, 1960, p. 32.

   Note that it is the practice of the Ontario Department of Lands and Forests to produce controlled mosaics at 1:15,840 of substantial portions of the Province. This practice is followed by other provinces to a greater or lesser extent.

interpretation cannot provide the information required on linkages or flows, which can only be supplied from published data or from sample surveys in the field.

The Application of Air Photo Interpretation to Homogeneous Region Criteria

Without doubt, there is considerable potential in the application of aerial photographs to the study of an individual homogeneous region criterion. Emphasis may be placed upon:

1. The distribution of the individual criterion, e.g. population, distribution of agricultural producing units, land use data. The interpretation of individual topics is well treated by Stone[2].
2. The relationship between the incidence of an individual criterion and a specific area, i.e. a measure of the density of a particular criterion within an area, perhaps a census enumeration unit.
3. The relationship between separate criteria. In other words, a visual assessment may be made of the correlation between selected criteria, individually interpreted and mapped.

In the foregoing reference has been made to "considerable potential". Can this potential be realized? A number of factors should be borne in mind when attempting an answer to this question, e.g.:

1. The coverage of the photography, in terms of:
   a. The percentage of the specific area covered by photography which, fortunately, embraces all of the project area and indeed, the greater part of Canada today.
   b. The date(s) of exposure. Generally speaking, aerial photography is exposed at intervals of time governed primarily by the

2. Stone, K.H., "A Guide to the Interpretation and Analysis of Aerial Photographs," Annals of the Association of American Geographers 54:318-328 (1964).

amount of development taking place in a given area, although it is also the case that a particular area may be re-photographed at the conclusion of a pre-determined interval of time. The dangers of out-dated photography are readily apparent in areas undergoing further development.

c. The purpose for which the photography is intended. It is well known that most air photo interpretation is carried out on photographs which were exposed for the purposes of topographic mapping, and often this means that the scale of the photographs is not optimal for the photo interpretation of specific topics. Occasionally, the type of photograph available, usually on panchromatic film, is not best suited for specific purposes in photo interpretation, for which infra-red, modified infra-red, or colour photography might be better. The question of multi-purpose photography has recently received the attention of the Inter-Departmental Committee on Air Survey, associated with the Federal Department of Mines and Technical Surveys, Ottawa, and has been discussed at Canadian symposia on air photo interpretation.

2. Related to 1(c) above is the scale of the photography. The circumstances applicable to the project area have already been discussed (see first page of Appendix). However, in general terms:

a. The larger the scale of the photography, the greater the number of photographs required to cover a given area, and the greater the amount of detail that can be recognized and interpreted, other things being equal. However, it is necessary to consider what part the interpretation of the aerial

photograph will play in the treatment of criteria.

b. The smaller the scale of the photography, the fewer the photographs required, and the more easy it is to recognize broad patterns within individual criteria. This has obvious application to the reconnaissance phase of a project.

3. The quality of the aerial photography, in terms of:

a. The quality of the photographic imagery. This is governed by a variety of technical considerations, an important one being the atmospheric conditions at the time of exposure.

b. The age of the photography in relation to changes that have occurred in the area since the exposure of the photography. The majority of photographs exposed in Canada by or on behalf of government are of high quality with respect to (a).

4. The quantity of photographs to be subjected to photo interpretation. An extensive programme requires careful analysis of time and cost factors, for an illustration of which the report by McClellan should be consulted [3].

5. The nature of the criteria to be analysed by photo interpretation. Certain of the criteria accepted for analysis in the project area cannot be subjected to photo interpretation, as already indicated. Where photo interpretation might play a part, it is necessary to evaluate that alternative information which is readily available, e.g. recently-published topographic sheets which could give data on transportation lines, settlements, forested areas; recently-

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3. McClellan, J.B., "The Land-use Sector of the Canada Land Inventory," Geographical Bulletin 7:73-78 (1965).

published thematic maps on aspects of physical geography, land use in agriculture and forests, distribution and other data on mineral and rock exploitation, etc. In certain circumstances, the capacity of the aerial photograph to yield information is limited when interpretation procedures are applied. For example, the distribution and density of agricultural producing units might be considered as an obvious topic for photo interpretation and mapping therefrom. Indeed, suitable techniques will elicit valuable information on this topic to an extent not possible with topographic or thematic maps, or from statistical returns by enumeration unit. However, there are limitations. For example, the presence of a farmstead in the aerial photograph does not always reveal whether it is occupied by a farmer or by a person having alternative employment, and therefore, whether it is technically an agricultural producing unit. Again, it is not always possible to deduce the boundaries of an agricultural producing unit, which may make unreliable a calculation of the number of such units in an enumeration area.

SUGGESTED TREATMENT

It would be possible to use recent and suitable aerial photographs of the whole area being examined for the analysis and interpretation of data relevant to selected criteria. However, the writer considers this to be an unlikely choice, because of:

1. The sheer volume of work to be accomplished, unless the region being defined is of manageable proportions. The cost factor is a principal consideration.

2. Possible economies in time and cost which might be effected by the use of published data graphically portrayed on a variety of media.

Should it be decided to undertake a comprehensive interpretation of the photographs, then a systematic approach should be considered, such as that suggested by Stone.

The more profitable approach appears to be the subjecting of selected areas and selected criteria to photo interpretation. A number of possibilities exist, inter alia:

1. Providing additional and/or more recent information to compensate for the inadequacies in topographic maps. The writer believes that topographic maps should be as much used as is possible in the exploratory or reconnaissance phase of the project, and in subsequent phases when specific criteria are being considered. The topographic map represents, in many cases, the result of a process of photo interpretation undertaken by the photogrammetrist. However, the topographic map becomes rapidly out-dated, and before extensive use in a project, a process of evaluation should be undertaken, to show:
   a. The date of survey revision, the method of revision, and the extent of revision; and
   b. The relationship of the published map sheets to the most recent photography.

   If cultural information is to be abstracted from the topographic maps then it will be necessary to check the completeness of the information shown on the maps by cross-checking with the aerial photography on a basis of random or selective sampling, and by field checking.

2. To fill gaps in the coverage of relevant thematic mapping, e.g. land use, forest cover type, etc. However, it is important to recognize the limitations of air photo interpretation, e.g. the inability of the interpreter to deduce the nature of crop and livestock combinations in agricultural land use, though both crop and livestock usage can be interpreted, and also to recognize that specialization in air photo interpretation exists. The availability of photo interpretation keys is not a complete solution to the problem of embarking upon the interpretation of a topic to which the interpreter is unaccustomed.

3. To provide additional data on the distribution and density of a given criterion, the available information on which constitutes statistical returns related to an enumeration unit. Variation in intensity may not be indicated adequately by such statistical returns, and the interpretation of a suitable criterion from the aerial photographs will provide more refined information on distribution and relative densities. As an illustration of the further use of this technique, let it be assumed that in the attempt to recognize a boundary of a homogeneous region, the density or intensity of a specific criterion is mapped by statistical enumeration units. Visual inspection of the resulting choropleth map[4] may indicate a hierarchy of densities or intensities, sufficient to focus attention upon a pattern of units through which a boundary

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4. " . . . maps which depict average values per unit of area over some administrative region for which statistics are available, such as density of population per square mile, the percentage of land under cultivation, and the yield per acre of arable land." Monkhouse, F.J., and H. R. Wilkinson, Maps and Diagrams. London: Methuen and Company, 1958, pp. 28-29.

might be drawn. Photo interpretation of the distribution of the criterion within these critical units may show more precisely where the boundary might be drawn, or alternatively may throw further light upon the problem of defining the boundary.

FURTHER CONSIDERATIONS

The matter of the use of topographic and thematic maps has been touched upon briefly. The writer believes that the evaluation of available maps of both varieties requires careful thought. The evaluation of topographic maps in terms of a mapping accuracy standard has received attention in a variety of places, at both the national and international levels. However, there is need for evaluation of content and means of presentation in both topographic and thematic maps for a project involving the delimitation of a region, so that already published sources of information may be used fully and wasteful effort eliminated.

A useful contribution in methodology could be made by the development of principles for the assessment of available cartographic sources.

Discussion of the potential use of aerial photographs has centred upon the photography exposed from fixed-wing aircraft, usually on panchromatic film with the axis of the camera vertical, as this represents 90% or more of available photography. Although panchromatic photography exposed in cameras, the axes of which have been inclined to the vertical, is available, there are several problems which may cause interpretation to be more limited. There is also a restricted amount of photography exposed on infra-red, modified infra-red, or colour film from fixed-wing aircraft, though the geographical distribution of such photography is highly irregular resulting from the infrequent, special needs of particular government departments and other organizations.

There is also an additional source of photography now available, that exposed from satellites in high-altitude orbits. The advantages of this type of photography, much of which has been recorded on black-and-white film, can be stated thus:

1. Because of the altitudes at which the photography is exposed, each photograph covers a considerable area at small scale. This has a significant potential in that, other things being equal, the interpretation of general patterns of distribution is facilitated.
2. Because of the regular passage of a satellite along given orbits, it should be possible to secure photography relatively free from the records of the weather. (The disadvantages lie primarily in connection with the recording of weather conditions which will obscure ground detail and reduce the potential value of this medium.)

Within the last five years, much thought has been devoted to, and work undertaken upon, the use of remote sensing devices in both fixed-wing aircraft and in satellites. The subject continues to receive much attention, particularly in the U.S.A. where a number of symposia have been held and the active participation of geographers encouraged through official channels. There is already considerable evidence to indicate the utility of the processes, e.g.:

1. The use of infra-red sensing in:
   a. Urban areas, where records of sensing show the finest detail of transportation routes, whether the sensing was undertaken by day or by night;
   b. The detection by military intelligence of vehicular movement beneath a vegetation cover;
   c. The detection of incipient fires in wooded country;

d. Terrain mapping.

2. The use of radar presentations recorded on film, which has been used in geological and geomorphological studies. The scope of the topic is undergoing constant modification, though the general applications in geography have been stated recently by Badgley[5]. It is exceedingly difficult to define the precise role(s) that remote sensing might play in the delimitation of a region, largely because:

   a. The limits of the possibilities have not yet been fully explored; and

   b. Much will depend upon the availability of remote sensing records, which in turn will be governed by the policies of government in regard to the undertaking of such missions.

Nevertheless, it is clear that this development cannot be ignored, and it is recommended that a study be undertaken of the application of such methods to the problem in hand.

In conclusion, it is evident that a close liaison should be maintained between that agency responsible for the establishment of policy concerning further delimitation of regions, and the Inter-Departmental Committee on Air Survey, to which reference has already been made.

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5. Badgley, P.C., "Planetary Exploration from Orbital Altitudes," Photogrammetric Engineering 32:250-259 (1966).